DOCUMENT RESUME

ED 223 258 IR 050 017

AUTHOR	Griffiths, Jose-Marie; King, Donald W.
TITLE	New Technology and the Public Library. Final Report and Executive Summary.
SPONS AGENCY	Office of Libraries and Learning Technologies (ED), Washington, DC.
PUB DATE	12 May 82
NOTE	141p.
PUB TYPE	Guides - General (050) -- Reference Materials - Bibliographies (131) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	Cable Television; Check Lists; Library Administration; *Library Automation; Library Personnel; *Library Planning; Library Role; Library Services; Microcomputers; Online Systems; *Public Libraries; *Technological Advancement; Videotex; Word Processing
IDENTIFIERS	Electronic Document Delivery; Electronic Mail; Electronic Publishing; Information Transfer; Library Funding; Library Users; User Fees; User Needs; Videodiscs

ABSTRACT

This report presents current and potential library applications of new technologies, issues surrounding their introduction into public libraries, and activities suggested for use during the introduction procedure. A brief appraisal of the public library's role in the information transfer process precedes a review of library automation in acquisitions, cataloging, reference, circulation, and serial control activities. Increasing investment in computer, communications, and information technology on the part of publishers, database producers, and library users is discussed as well as the effect on libraries of electronic publishing, word processing, electronic mail, electronic document delivery, videodiscs, microcomputers, cable television, videotex, and teletext. An analysis of the issues involved in the introduction of new technology in public libraries concentrates on library funding and user charges, with shorter sections on questions of education and training, information quality control, copyright, invasion of privacy, and private/public sector relationships. Following a brief consideration of overcoming resistance to change, a planning outline for use in public libraries during the introduction of new technology is presented, which includes sections on how to get started, feasibility analysis and design, equipment selection and procurement, dealing with personnel and physical environment problems, and post-implementation evaluation. Sixty-one references, a glossary, and a list of consulting firms are provided. (ESR)

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NEW TECHNOLOGY
AND THE
PUBLIC LIBRARY

FINAL REPORT
AND
EXECUTIVE SUMMARY

Submitted by:
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Prepared for the United States Department of Education, Office of Educational Research and Improvement, Office of Libraries and Learning Technologies. (The contents of this paper do not necessarily reflect the views or policies of the Department of Education.)

May 12, 1982

IR050017

EXECUTIVE SUMMARY

Recent advances in technology have led to significant improvements in performance and reductions in the cost of automated systems. As a result, two trends have evolved which are seriously affecting the library profession. These trends are:

- rapid increase in the number of information processing organisations developing new information products and services;
- rapid improvements in the capabilities of data processing equipment available at steadily decreasing prices.

The traditional role of the library in terms of the materials handled and mode of operation is being continuously eroded as a result of technological change. In this report we discuss the emerging technologies and their effect on the changing role of public libraries.

There are essentially two ways that new technology will affect public libraries. One is to provide them with more sophisticated, more efficient, more reliable and less expensive information systems, products and services which assist librarians in managing and organizing their own internal operations. The other relates to the changing external environment of the library as manifested in electronic publishing techniques, database production and home information utilities. In order to preserve their position in the community, public libraries must respond to their changing external information environment. If that environment is partially but increasingly electronic in its nature, then libraries must evolve to reflect this change.

Technological innovations will inevitably lead to changes in the way we acquire, process, store, retrieve, transmit and use information. On the whole, it is anticipated that future information systems will evolve based on a complex interaction between new technologies (such as microcomputing), new communications media (such as satellites) and new concepts for dissemination of information (such as Videotex). The developing technologies which we feel will affect libraries directly from the outside are:

- Electronic publishing
- Word processing and text editing
- Electronic mail
- Electronic document delivery
- Graphics
- Cable TV
- Videotex
- Teletext

The technologies under development that will influence a library's internal operations are fully integrated library automation systems. Such systems, although not available today, will become a focal point for library operation, and will evolve around the large scale cataloging utilities (OCLC, RLIN, etc.). These large-scale national systems and local integrated systems will continue to co-exist, with libraries accruing the benefits of shared cataloging, yet maintaining control of such functions as circulation.

We anticipate that libraries can participate in these developments in two ways. They can acquire, store and disseminate new forms of materials relating to the technologies (such as computer software, optical disks, etc.), and they can provide equipment to make use of those materials to patrons who either do not have access to such equipment at all, or who need immediate access while away from their homes or offices. In fulfilling either of these two roles, there are a number of issues which need to be addressed by the library community. They are:

- education and training
- quality assurance
- ownership and copyright
- privacy and protection
- funding
- public and private sector relationships.

The success of any project to implement change in an already operational environment is dependent on careful planning. This is especially true when the project involves the incorporation of new technology and anxiety among those who will be working with it.

In order to plan effectively, libraries must:

(1) understand the capabilities and limitations of individual technologies and combinations of technologies;

(2) understand how technologies can apply to the information needs of the user community; and

(3) understand how to implement the technologies with a minimum of disruption to existing procedures.

This report is intended to provide technical assistance to state and local library planners. The planning process discussed revolves around the notion of active participation by people at all levels, including funders, administrators, managers, librarians, and patrons. This participatory approach is intended to overcome much of the instinctive resistance to technological change observed in the library profession. The report is intended to inform librarians about:

- current application of new technologies* in libraries

- potential applications of developing technologies in public libraries

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*For the purposes of this report, new technology is defined as any technology that was not commonly employed in public libraries at the time of writing.

- issues surrounding the introduction of new technologies into public libraries

- activities required to introduce new technologies into the public library environment.

This report is meant to be used as an introduction to the field and as a basic guide to initiating a planning process for introduction of new technology into libraries. As further aid, we include a list of practicing consultants who can further help libraries with their new technology endeavors.

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CHAPTER 1

INTRODUCTION

One of the nation's greatest resources is information. It is used extensively in such daily activities as coping with everyday problems, recreation, schooling, education and work. Most of our greatest achievements in industry, science, technology, medicine and education may be attributed in a large part to the intensive use of information. In the U.S., in order to successfully govern our society, the government spends tens of billions of dollars on collecting and using information[29]. Information has become such an important part of the U.S. society that it has been estimated that about 45 percent of the Gross National Product and 58 percent of the workforce is engaged in information related activities[48,54]. Information industries have blossomed in the U.S. and other high technology countries.

A 1980 survey of information professionals in the U.S.[11,28] estimates that there are at least 1.6 million professionals engaged in information transfer processes. These activities include 270 thousand persons that manage information organizations, about one million in information operations, 370 thousand in system design and analysis, 20 thousand in information research and 43 thousand in educating or training information professionals or workers. Most of these information professionals are found in industry with 1.2 million, followed by state and local governments with 370 thousand, Federal Government with 80 thousand and academic institutions with 30 thousand professionals. There is little doubt in the U.S. that information plays a highly important role in our society.

In analyzing the background activities for the White House Conference on Library and Information Services in the U.S.,[31] it became clear that the diverse use of information should serve as the structure for the conference. This structure seems appropriate in a general way as well. Five conference themes were derived from the uses of information, which form another dimension of information transfer. These uses are categorized as follows.

1. Use of information for meeting personal needs, as in:

   - Solving day-to-day problems (e.g., in consumer awareness, nutrition, transportation, money matters, taxes, and employment)
   - Coping with trauma of crisis (e.g., at the time of emergency, death, illness, divorce, loss of job, or drug addiction)
   - Becoming informed about news and current events
   - Participating in elections and public policy decisions
   - Accommodating entertainment, recreation, and leisure activities

2. Uses of information for lifelong learning for:

   - Preschool-age children
   - Persons involved in formal education at all levels
   - Adults who have interest in continued self-instruction
   - Persons of all ages who are illiterate

3. Uses of information:

   - In organizations that provide products and services (e.g., businesses, utilities, farms, hospitals, and research groups)
   - In organizations that provide a benefit to groups of individuals or organizations (e.g., societies and associations; unions; civic, charitable and advocacy groups; and foundations)
   - By professionals, including lawyers, doctors, scientists, engineers, social workers, and so on

4. Uses of information for governing the society through:

   - Describing the nation (e.g., census of the population, weather, cartography, health statistics, labor statistics, etc.)
   - Government operations (e.g., public services, making laws, law enforcement, regulations, justice, research, intelligence, etc.)

5. Uses of information for international purposes, such as:

   - Cultural exchange
   - Scientific and technical and other professional or services exchange
   - Trade, monetary, or other intergovernment exchange
   - Shipping and other transportation exchange

These five areas are hardly exhaustive (or even quite mutually exclusive), but they do serve as a useful grouping of information uses, and they demonstrate the full extent of information use by persons.

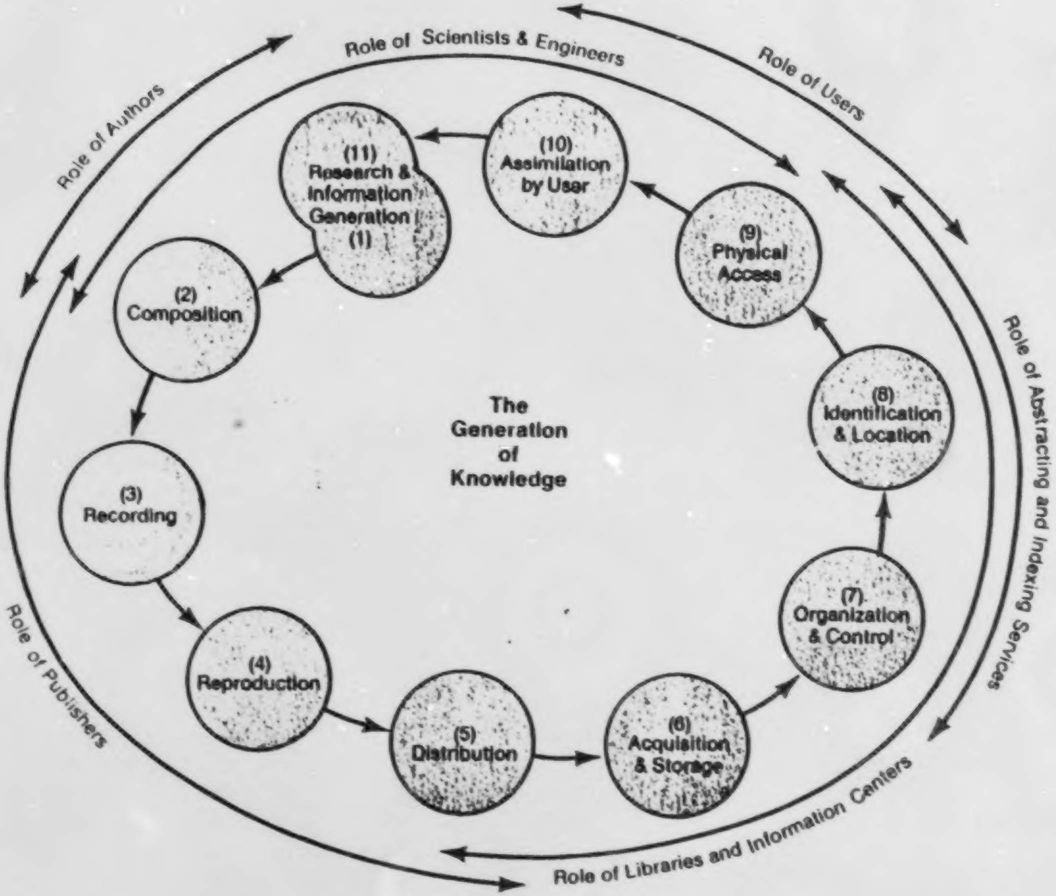
Public libraries are or may become involved in every one of the use categories of uses mentioned above. The advent of new technology in public libraries will make this even more true in the future. Use of Videotex in public libraries will substantially enhance use of information for meeting personal needs in all the sub-categories above. Computer-aided instruction may become an important part of public library services in which case new technology employed in libraries will increase and improve uses of information for lifelong learning. Uses of information in all types of organizations can be improved through services provided by libraries. Already, public libraries provide hundreds of thousands of online bibliographic searches to organizations[36]. Public libraries, partially through the depository library system, currently provide access to the public for information used to govern our society. New technology is likely to increase availability and use of such government information in the future. Similar extended use of international information will also become commonplace through the application of new technology.

However, in order to understand how new technology can best be employed in public libraries, it is helpful to review the role of the public library in the overall information transfer process. In addition to recognizing the extensive potential uses and users of the public libraries mentioned above, there are new, non-traditional functions that may be performed by public libraries if they can be recognized. In describing information transfer (in science and technology), King Research [29] identified the principle functions that are performed and the participants, including libraries, that perform these functions.

The relationship among information transfer participants and functions may be expressed in terms of a spiral, as shown in Figure 1. New technological tools may alter the methods of transmitting information, but not the nature of the information transfer spiral itself. The information transfer spiral is most appropriate for published documents, although the functions described in it are also applicable to other forms of communication, such as television programming, conferences or computer data base searches. The spiral includes ten functions that are essential for transferring information in a variety of media, from convenient sources, at the time information is needed.

It is convenient to consider the spiral in Figure 1 as beginning at generation of information (1). This function is the role of authors, writers, scientists, engineers, lawyers or whoever generates ideas or information. As a result of

Figure 1 · The Information Transfer Spiral


Role of Scientists & Engineers
Role of Users
Role of Authors
Role of Abstracting and Indexing Services
Role of Publishers
Role of Libraries and Information Centers
(11) Research & Information Generation (1)
(10) Assimilation by User
(9) Physical Access
(2) Composition
(8) Identification & Location
The Generation of Knowledge
(3) Recording
(7) Organization & Control
(4) Reproduction
(5) Distribution
(6) Acquisition & Storage

Source: King Research, Inc., 1977.

the generation of information, manuscripts (books, magazines, newspapers, journal articles, reports) are composed (2). The composition function refers to formal writing, editing and reviewing of the manuscripts. When a manuscript is in a form to be communicated, it is recorded (3). These last two functions are the role of authors, publishers, editors and reviewers. At this stage, authors have as yet very little impact on the reader or user community. Only when the work has been reproduced and distributed does it gain the potential for widespread influence on an audience beyond the author's circle of friends and colleagues.

The reproduction (4) and distribution (5) functions are usually the role of the publisher. However, the authors, colleagues and libraries also play an important role in reproduction and distribution. Transfer of documents among these three participants may be thought of as indirect reproduction and distribution which requires acquisition and storage (6). Although many individuals acquire books, magazines, newspapers, journal articles or reports, and may store them, this function is primarily the role of libraries and other information centers. Through their acquisitions and storage policies, libraries provide a permanent archive of this information. But this becomes significant to society only when the following functions (or activities) occur.

Libraries also have an important role to play in organization and control (7) functions. In addition to collecting publications, libraries and other information centers provide access to these materials through cataloging, classifying, indexing and other related procedures. The major indexing and abstracting services and bibliographic services play an important part in organization and control as well. Needed publications may be identified and located (8) by a number of of processes including reference to one's own subscription, library search, and computerized search and retrieval systems. This function is often accomplished for the user by an intermediary from a library or other information service - a reference librarian or online searcher, for example. The physical access (9) function includes direct distribution of publications from publishers to users, indirect distribution through libraries and other information centers, and distribution of reprints by the author.

The final function in the spiral, that of assimilation by user (10), is the least tangible. The assimilation function is the stage at which information (as opposed to documents) is transferred. It is at this stage that the state of the user's knowledge is altered.

The communications process is presented as a spiral because it is continuous and regenerative. Through assimilation, a reader may gain information that can be used to generate new knowledge which is, in turn, composed and recorded for another cycle through the information transfer spiral.

Particularly important are the intrinsic systemic and economic interrelationships among information transfer participants. Also important is the fact that the lines of functional performance are becoming blurred. For example, one could argue that reproduction is being performed extensively in libraries through photocopying. New technology is likely to make the distinctions even more blurred in the future. For example, use of Videotex in libraries may result in the libraries performing composition and searching of information put into the system since they are the source of much of the information and they have backup materials for answers to many questions. The point is that, as one reads this monograph, some thought should be given to new roles that public libraries might play and new functions that they might perform in light of the new technology described below.

CHAPTER 2

BACKGROUND

2.1 Trends in Use of Technology by Public Libraries

Tracing the history of the application of technology in libraries is not too difficult a task. Traditionally, technology has been utilized to support each of the major functional areas of library activity. These are

- acquisitions
- cataloging and catalog production
- circulation control
- serials control
- reference

Automation was first applied in libraries during the early 1960s. At that time computers were physically very large and required almost equally large air conditioning units. Certainly, such equipment was too expensive for any single library to own and libraries began to share computers with their parent organization or with other libraries. Sharing a computer with one's parent organization posed serious priority problems. Often, the computer was primarily used for payroll and accounting for counties, regions, etc. Obviously, payroll and accounting took priority over library applications which were, on the whole, considered peripheral. Such an arrangement was fairly satisfactory for applications which were not time-critical (particularly as these large computers were mainly operating in batch* mode), for example, catalog card production. Some libraries did attempt to maintain circulation files which were updated every 24 hours, but at the end of the month when payroll applications were being run, the circulation files were often up to 72 hours out of date. On the other hand, the sharing of a large computer by several libraries was very successful, particularly in establishing the basis for future cooperation and resource sharing. Perhaps the most significant arrangement of this type was the Ohio Colleges Library Center, OCLC (now known as Online Computer Library Center), which began as a cooperative project and evolved as one of the major bibliographic utilities available today.

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*See Glossary.

The next major technological change relevant to library operation was the introduction of online* computer systems. These systems gave almost instantaneous feedback and, therefore, helped to overcome the file updating problems referred to earlier. However, online systems were still very large and expensive and, in order to take advantage of them, libraries had to participate with others.

During the late 1950s, significant advances were being made in computer technology. Efforts had been underway for some time to reduce the physical size of computers by miniaturization of their components. The driving factor behind such developments was the requirement, in military and aerospace applications, to couple increased computer power with smaller, lighter and more reliable machines. The breakthrough was achieved in 1959 with the production of the integrated circuit* as the basic component of what came to be known as minicomputers. The integrated circuit could be mass produced at considerably lower cost than previous circuits. As a result, the price of minicomputers fell within the range of many single organizations including the larger public libraries. In addition, the integrated circuit technology was much more reliable than before and the computers based on the technology were not as sensitive to environmental change (temperature, humidity, etc.) as the larger machines.

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*See Glossary.

The first minicomputers were relatively small, single purpose computers which could operate without large-scale environmental control. For this reason, and because of their relatively low cost, minicomputers were considered suitable for library automation applications. During the early 1970s, libraries began to make use of minicomputers but encountered both hardware and software limitations. The first minicomputers were rather unsophisticated, difficult to program, and were unable to handle both large numbers of transactions and still produce a fast response time. However, as more software became available for minicomputers, their potential for application in libraries increased.

One significant change, associated with minicomputer development, was the emergence of commercial software producers. Prior to this, software had always been provided as part of a system package (hardware, software, maintenance). The increasing realization that minicomputers could be adapted to the particular requirements of a range of applications led to the "unbundling" of software. This meant that hardware and hardware maintenance were provided by one vendor, and software and software maintenance by another. The software vendors initially produced software for a variety of different applications but, over the years, have tended to specialize with the result that today there are a large number of them dealing almost entirely with library automation. The software, having been written for operation on one or more computers, is usually available either on its own or as part of a turnkey* system (hardware, software and maintenance).

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*See Glossary.

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The vendors developed stand-alone systems each relating to single library functions such as circulation control, acquisitions, serials check-in.

Basically, there have been two trends in the introduction and development of automation in libraries. One involves the implementation of essentially single function systems based on minicomputer technology. The other involves the use of a shared large-scale computer through a cooperative or bibliographic utility. These two trends themselves tend to have concentrated on different library functions. The stand-alone systems, particularly in public libraries, have been concentrated in the area of circulation control, whereas the bibliographic utilities have provided cataloging aids and catalog production. It is interesting to note that as these two alternative approaches to library automation began to expand into other functions (acquisitions, serials control, interlibrary loan), the distinction between them became less obvious. Each approach has its advantages. The stand-alone approach offers local control and allows local practices and formats to be used. The shared approach allows access to the records of other libraries which results in economies by sharing the effort of input. It is possible that with the increasing networking capability of minicomputers that the two approaches could eventually become virtually identical from the library's viewpoint. However, we are more likely to see a merging of the two approaches. For example, interfaces are available today which allow a librarian to create a catalog record using one of the utilities, and transmit that record to an in-house minicomputer for eventual use in circulation control. The future trend is towards fully integrated library automation systems (see Chapter 3). It will be some years before such systems are common. Meanwhile, the individual functional components of library automation systems are continually improving.

2.2 Acquisitions

There is a considerable level of effort being devoted by vendors of library automation systems and services to acquisitions modules. Essentially, two types of systems are in development. The first is an acquisitions service offered to libraries by book jobbers. These are organizations that act as distributors of books and serials, acting as middle-men between publishers and libraries. The advantage of dealing with a jobber rather than directly with a publisher is that the library need only transact with one single agent to obtain materials from many different sources. At present, two major book jobbers offer online book ordering as part of their service. This service results in considerably improved turnaround time for receipt of items ordered. In some cases, orders are filled within 7 days. These jobbers tend to handle a wide range of materials and therefore, their online databases are much more suited to public library acquisitions than to the special library environment. The "hit rate" for public libraries is often over 75 percent. The hit rate is a measure of the proportion of those items to be ordered that are distributed by the jobber and, therefore, that have a descriptive record in the database. Obviously, as more jobbers, and the publishers themselves, set up online databases describing the publications they have in stock, the hit rate achieved from a single service will become less important.

In addition to online ordering, a number of other optional services can be made available. Pre-order search capabilities permit author, title, subject and other searches of the entire database to aid selection of items for ordering. Funds accounting assists libraries to manage their book budgets. Finally, the current status of orders can be tracked by recording order date, receipt date, payment date, etc.

These services currently focus on book acquisitions but could eventually be expanded for ordering and acquisitions of serials. The particular problems encountered in controlling the acquisition and distribution of serials are discussed in more detail later (see p. 23).

Closely related to the online ordering services is the provision of machine-readable magnetic tapes (acquisition tapes) with the orders. The two book jobbers referred to above as well as several publishers and other jobbers offer these tapes. The tapes are in MARC*format and contain a record for each item ordered, and could ultimately be used for input to a machine-readable catalog.

The second type of acquisitions system exists today either as a stand-alone system or else as a module in a complete library automation system. Many stand-alone acquisitions systems run on minicomputers and even some on microcomputers. The major features of such systems include the production of orders, claims, cancellations, receipts, routing slips, management reports and financial reports. The systems usually handle partial MARC records. When part of a total library automation system, the acquisitions record is the base record used for generation of a master bibliographic file, as indicated in Figure 2.

The development of fully automated acquisitions systems has not proceeded as fast as, for example, circulation control systems, but in the near future many of the bibliographic utilities (OCLC, RLIN, WLN, etc.) will have fully developed acquisitions modules.

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*See Glossary.

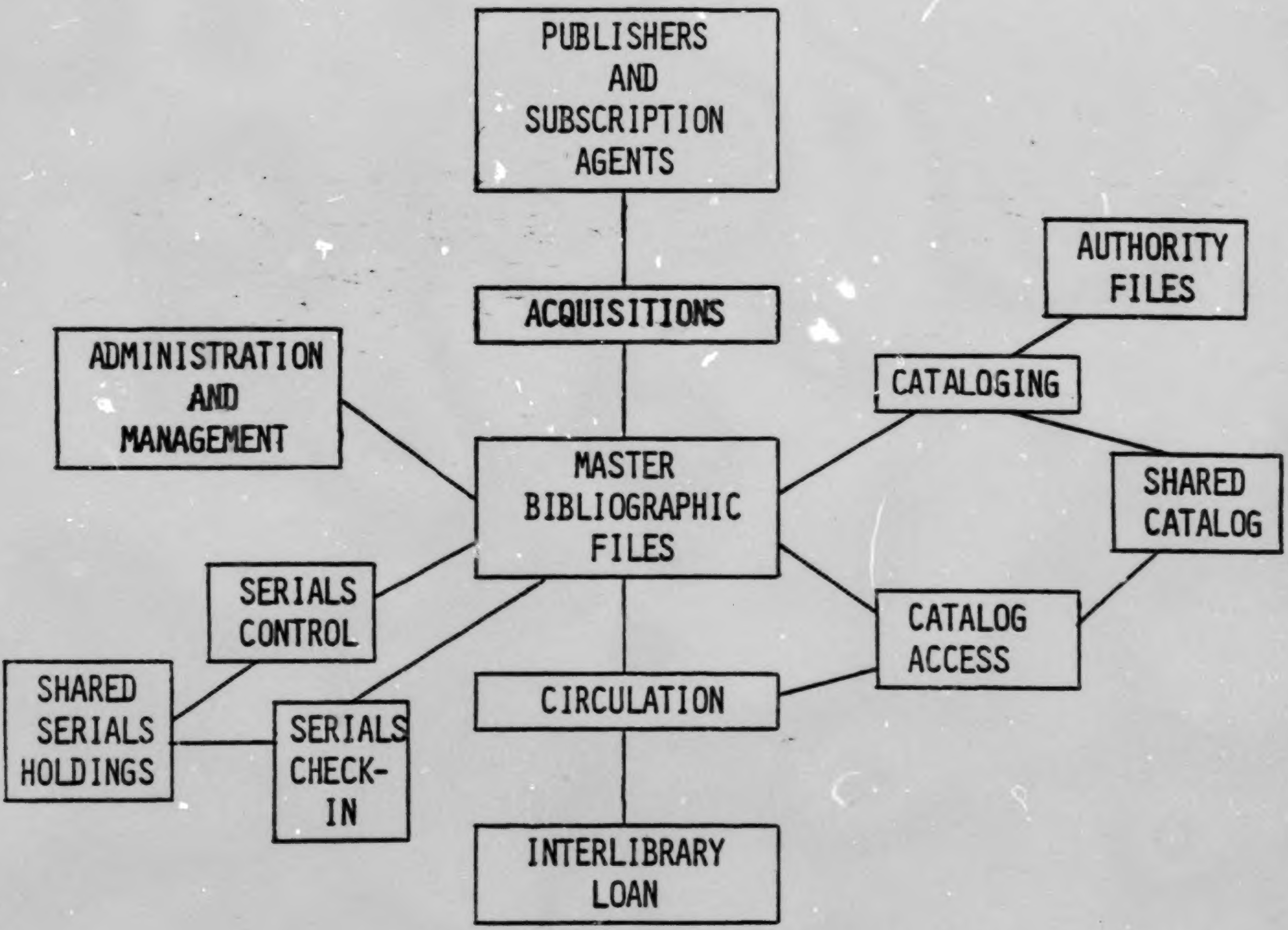
PUBLISHERS AND SUBSCRIPTION AGENTS
ACQUISITIONS
AUTHORITY FILES
CATALOGING
ADMINISTRATION AND MANAGEMENT
MASTER BIBLIOGRAPHIC FILES
SHARED CATALOG
SERIALS CONTROL
CATALOG ACCESS
SHARED SERIALS HOLDINGS
SERIALS CHECK-IN
CIRCULATION
INTERLIBRARY LOAN

Figure 2. Integrated Library Automation System

Libraries acquire materials not only from vendors and jobbers but also from other libraries through interlibrary loan agreements. The main factor influencing the success of interlibrary loan activities is the ability to find out which libraries hold the item required. For example, the bibliographic utility OCLC serves as a medium for interlibrary loan activities. The records held in the OCLC cataloging files each contain "holding symbols" that represent libraries which have cataloged that particular item. Once the libraries holding the required item have been identified, a loan request can be made online. There are two limitations to such a service. The first is that only those titles cataloged by the libraries holding membership of the utility can be searched. The second is that only those member libraries can search the cataloging files. However, as the use of such utilities increases, so does the potential to use them for interlibrary loan requests. A number of bibliographic utilities have evolved, including OCLC, RLIN*, WLN*, SOLINET*, AMIGOS*, etc. Another significant development that will influence interlibrary loans is the creation and maintenance of online catalogs (see p. 19 for a more detailed description).

2.3 Cataloging and Catalog Production

The major trend, over the years, in cataloging has been the development of shared cataloging systems. These were set up in the 1960s by cooperatives of libraries such as those comprising OCLC primarily for catalog card production. Originally, OCLC had 54 member libraries, but growth was rapid and today OCLC has 6000 member libraries. In addition, several other similar groups were formed, e.g., RLIN (Research Libraries Information Network), UTLAS (University of Toronto's Automation System), or WLN (Washington Library Network). These bibliographic utilities as they are known provide access, by member libraries, to the cataloging records of all members. Each library can search for a cataloging record for a known item (book, journal issue or other material). If a cataloging record already exists (i.e., one of the other libraries has already cataloged it, or the official Library of Congress record is available), then the library can copy the existing record or modify it for local use. If a record is not found in the database, then original cataloging is necessary, or the library can wait to catalog the item until a record is available. Each library has its own subset of the main database containing the cataloging records for its holdings. Essentially, these are different "user views" of the database. The records are tagged with a "holdings symbol" indicating which libraries in the system hold a particular item.

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*See Glossary.

There are no set patterns on how libraries utilize the cataloging services of the bibliographic utilities. For example, libraries do not have to make use of the catalog card printing services. They can receive machine-readable catalog records on magnetic tape, on a regular basis for loading onto an in-house minicomputer. They can use an interface that will permit the reading of a bar code label as part of the record for a particular item. Printers can be attached to the terminal so that spine and book labels can be printed on demand. The limits to such services depend on the contract drawn up between the utility and groups of libraries.

Matthews[39] states that any changes in the way in which cataloging is currently done in libraries will be the result of conscious management decisions rather than the impact of technology. He continues by warning that large cost savings in the cataloging area as a result of the use of cooperative networks are unlikely. Instead, such services allow other changes: changes in organization, in level of personnel assigned to cataloging, and in work flow and procedures. Pierce and Taylor[47] suggest that one of the prime reasons for the adoption of cooperative network cataloging systems is to trade higher cost professional positions for lower cost paraprofessionals.

As well as the advantages of improving the throughput of items from receipt to shelving, thereby providing users increased access, the utilities have, in recent years, expanded their range of services. An extension of the shared cataloging concept is the introduction of interlibrary loan request placement. If a library has access to the cataloging records of many other libraries, and each record is tagged with holdings symbols, then requests for individual items can be recorded easily.

There are a number of limitations to use of the bibliographic utilities, based almost entirely on the existence of several compatible utilities (OCLC, RLIN, WLN, etc.). In general, libraries subscribe to only one utility. Therefore, they only have access to the records of other libraries subscribing to that service. Libraries are beginning to have full subscriptions to one utility, and a search and ILL request account only with others. A serious problem with the interlibrary loan service is that those libraries who input their records into the utility's database, tend to receive a disproportionately high number of requests for loans, which results in a certain reluctance to participate in such cooperative ventures. Nevertheless, the advantages are considerable and become even more so as the number of participants increases.

In addition to the utilities, a number of other options provide cataloging assistance to libraries. The Library of Congress produces its MARC (Machine-Readable Catalog) records on microfiche through a commercial vendor in addition to its book-form Union List. A stand alone online system called MINI MARC provides the LC MARC records on floppy disks. As mentioned in the previous section, a number of book jobbers provide machine-readable records on magnetic tape (usually some variation of a MARC record) for each item ordered through them.

The current trend is for increasing numbers of libraries to use the utilities through regional networks. There is considerable discussion of the potential for a national library network achievable through linking the utilities, but significant changes to procedures and formats are necessary before a single unified network can be realized.

The catalog is the means by which a library user can determine the resources available within the library on a specific topic or whether a particular item is held. Ganning[17] indicates that there are eight factors affecting the use of the catalog. They are:

- usability
- availability
- completeness (up-to-date)
- ability to personalize
- expandability
- flexibility
- format
- productivity of those who produce catalog.

Today, the library has the option of four types of catalogs. These are:

- the card catalog, which may be produced manually or prepared with the aid of a computer (e.g., via a utility);
- the book catalog, which is computer-produced and photocomposed;
- the microform catalog, which is computer-produced; and
- the online catalog.

In most public libraries today, the predominant form of public access catalog is still the card catalog. However, as more public libraries begin to automate, the greater the probability of online catalogs. The main problem which is holding back the development of online catalogs is that of retrospective conversion. Consequently, many public libraries have two forms of catalogs: the original card catalog, closed as of a certain date, and an online catalog covering only a more recent period of time. Some libraries have been converting older records from card format to machine-readable format only as those items are checked-out.

The microform catalog gained some popularity in the early 1970s, but user reaction to them varied. Their acceptance in public libraries was slower than, for example, in academic libraries. Consequently, many public libraries have the opportunity to move directly from a card catalog to an online catalog. Today, user resistance to online catalogs is lower than user resistance to microform catalogs. This is the result of increased exposure of the general public to automation and interaction with computers (mainly through computer games).

2.4 Circulation Control

Circulation control has been aided by the use of computers for many years and is an area where public libraries have been fairly heavily involved. Originally the computers were large, batch oriented machines, often shared with other automation applications such as accounting, payroll, etc. Today, circulation systems are available as minicomputer-based turnkey systems.

Essentially, there are two types of online circulation systems. In one, records are maintained only for those items that are checked-out or otherwise absent. In the other type, a file is maintained of records for all titles, regardless of their current circulation status. Most automated minicomputer turnkey systems available today are of the second type.

There are a large number of features available on automated circulation systems. In general, a system should:

- merge borrower, item, and date together rapidly and accurately
- provide rapid retrieval of information so that item status or borrower status can be determined
- check returned items against reserved lists
- prepare overdue notices
- prepare lists of items on loan to any borrower and check for excessive numbers of loans

- detect delinquent borrowers particularly at check-out
- update materials returned in files and add any files to appropriate borrower account
- prepare management information
- perform these tasks reliably and economically.

Optional, but desirable features include:

- registration of patrons
- renewal capability
- complete fines accounting
- database search capability - by author, title, subject, item number, ISBN number, etc.
- display item status, e.g., no. of copies and whether or not checked out
- block excessive borrowing.

A number of options for item identification are available. Fairly common, is the use of bar codes and OCR (optical character recognition) machine-readable labels. These have similar characteristics in that labels can be fixed to all types of items (books, magazines, phonograph records, film cartridges, etc.) and need not be removed for check-in or check-out. Consequently, they are less susceptible to wear-and-tear then the older pocket and card systems.

Patron identification is achieved in a number of ways, including a plastic ID card with magnetic strip (similar to credit cards or bank transaction cards), punched cards, and OCR and bar code labels mounted on cards.

A significant development in recent years has been the introduction of automated interfaces between some of the bibliographic utilities and some online circulation control systems. These interfaces transfer catalog records created and stored at the utility to in-house circulation systems, literally at the push of a button. Currently, only a few interfaces are available, but in the not too distant future it is expected that most circulation system vendors will have developed (or had developed by a third party) interfaces to at least one utility. Such developments will alter the timescale within which a national library network might be achieved. Problems of incompatible systems will be reduced to incompatibility between utilities (not that this in itself is an insignificant problem), but instead of considering over 100 systems, the problem is reduced to half a dozen utilities.

2.5 Serials Control

The majority of automated serials control systems are in academic or special libraries. There are three broad functions that are most frequently automated. The first function relates to accessions. This includes the selection, ordering, receiving, renewal of subscriptions, and sending of claim notices when issues are not received. The second function is a bibliographic function aimed at providing lists of serial holdings and the location of current and past issues that are to be bound. Finally, the third function involves subscription control. Each issue is tracked during the circulation process, through binding, and renewals identified.

Problems arise in serials control systems as a result of sometimes unpredictable publishing schedules and the variety of distribution methods which mean that a library often receives serial issues out of sequence. The recording of receipts of issues is therefore critical for collection control.

Once information about the serials collection is in machine-readable form, a variety of listings can be produced, including lists by title, subject and location. The form of the lists varies from online display, to microform, to paperform. Union lists of serials collections for libraries within geographic regions are becoming increasingly popular. With library budgets falling and prices of serials subscriptions increasing, many libraries have allowed some of their serials subscriptions to lapse. It is, therefore, becoming increasingly important for libraries to be able to locate serials runs.

2.6 Reference

Reference services involve a variety of activities including referral, and use of indexes, abstracting services, and other secondary information products. Up until now public libraries have not exploited the use of new technology for reference activities as much as they might. The main area where some technological application has been used is online database searching. These databases were originally produced in book form, and many still are, and subsequently in machine-readable form. The databases (there are currently over 500 commercially available online) can be searched remotely, from the library by means of telephone communications and a computer terminal. The larger public libraries do offer online search services to their patrons, but the major concern regarding the introduction of such services has been how to charge users (for a detailed discussion of alternative charging policies, see p. 73).

One of the more unusual applications of computer technology in a public library was the Community Memory Project initiated in the San Francisco area in the early 1970s. The basic concept was for public management of public information. The system consisted of a network of small computers with large memories, each connected to between 10 and 20 computer terminals located in public places. The San Francisco Public Library and the Berkeley Public Library participated as terminal hosts, as did several local stores. The network could then be used as an electronic bulletin board. The project is worthy of note (even though it is no longer active because of lack of funds to maintain the system) because it was one of the first systems that did not require people to own their own computer terminal. It can, therefore, be considered a forerunner of Videotex-type systems.

CHAPTER 3

FUTURE TECHNOLOGICAL TRENDS AND RELATED ISSUES

Technological innovations will inevitably lead to changes in the way we acquire, process, store, retrieve, transmit and use information. On the whole, it is anticipated that future information systems will evolve based on a complex interaction between new technologies (predominantly based on microelectronics), new communications media and new concepts for dissemination of information. These future systems, in turn, will affect every aspect of our lives. They will affect our work, our education, our leisure and our day-to-day activities. As a result of these changes, the role of the public library, and our interaction with it, may change significantly. The first part of this chapter discusses those technological developments which are most likely to apply to public library operation. Each is described in terms of its potential application in public libraries. The second part of this chapter considers the problems and issues that could arise as a result of the application of the technologies to public library operations. In particular, any changes in the role of the public library within society will be discussed.

3.1 Emerging Technologies Potentially Applicable to Public Library Operations

The various information technologies and their related systems, products and services can be grouped according to their potential application to those activities within the information transfer spiral (see Fig. 1) which fall within the role of libraries and information centers. The relationship between activities and likely information technologies are displayed in Figure 3.

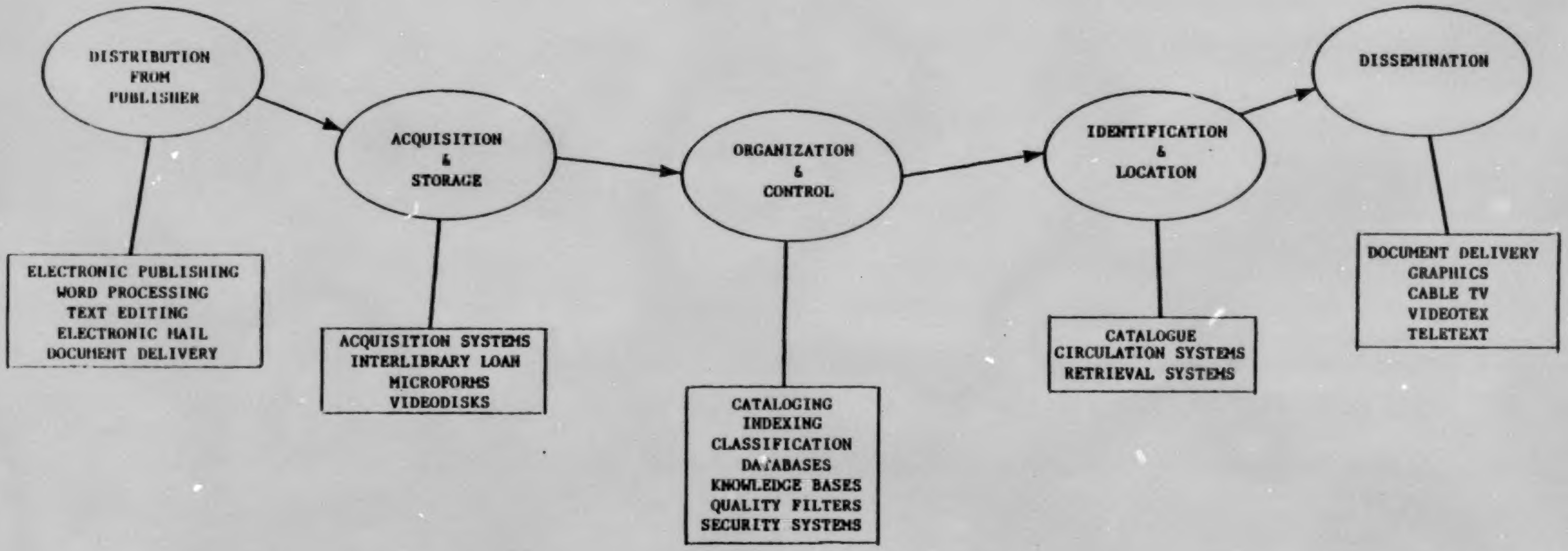
DISTRIBUTION FROM PUBLISHER
ACQUISITION & STORAGE
ORGANIZATION & CONTROL
IDENTIFICATION & LOCATION
DISSEMINATION
ELECTRONIC PUBLISHING
WORD PROCESSING
TEXT EDITING
ELECTRONIC MAIL
DOCUMENT DELIVERY
ACQUISITION SYSTEMS
INTERLIBRARY LOAN
MICROFORMS
VIDEODISKS
CATALOGING
INDEXING
CLASSIFICATION
DATABASES
KNOWLEDGE BASES
QUALITY FILTERS
SECURITY SYSTEMS
CATALOGUE
CIRCULATION SYSTEMS
RETRIEVAL SYSTEMS
DOCUMENT DELIVERY
GRAPHICS
CABLE TV
VIDEOTEX
TELETEXT

Figure 3. Relationship Between Potential Information Technologies and Library Activities

Before discussing each of these information technologies, in turn, it is worth noting that they are predominantly based on fairly recent advances in the areas of microelectronics and digital communications. Microelectronics is a branch of electronics that involves the fabrication of complete electronic circuits in tiny slices of semiconductor* material (commonly referred to in the popular press as silicon chips). These circuits are the basic building blocks of today's computers. During the last decade, developments in microelectronics have reduced the size of circuits, and increased their reliability and speed of operation, by several orders of magnitude. The fabrication techniques lend themselves to mass production, so that the cost per circuit has fallen dramatically. The net result of these advances is the significant improvement in computing (or data processing) capability for a given cost. This means that organizations with large computing requirements can fulfill those requirements at lower cost, and organizations with small-to-medium computing requirements can now afford to invest in the appropriate equipment. Libraries demonstrate this trend very well. In the 1960's, libraries made use of computing equipment owned by their parent organization or formed co-operatives in order to maximize the use of computers. During the 1970's, minicomputers began to appear in individual libraries, and now, during the 1980's, we are beginning to see microcomputer applications in libraries.

The second area of advancement is that of digital communications. The predominant form of communication technologies, until recently, has been analogue. Analogue communication involves the transmission of messages as a continuous stream of varying signals which is sampled over time and then reconstructed at the destination. The shorter the time between samples, the more accurate the transmission.

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*See Glossary.

Digital communication, on the other hand, transmits the message as a coded series of discrete signals. Because only the presence or absence of a signal need be detected, and no measurement of the relative strength or pitch of a signal is required, digital communication is significantly more reliable and accurate than analogue communications. The new, digital communication systems are based on optical fibre technology. The advantage that digital transmission has over analogue, beyond efficiency, is that it is suitable for a variety of communication types: voice, video, facsimile, computer generated data streams, microwave and satellite, thereby enabling the optimization of communication channels.

These two trends, the miniaturization of electronic circuits and the shift from analogue to digital modes of communication, form the basis for most of the new information technologies identified in Figure 3. These information technologies, although potentially applicable across several activities, can be separated into two distinct groups. The first group relates very closely to the types of activity described in Chapter 2 - the management and control of *internal* library operations. The second group is developed in environments *external* to the library, but will have significant influence on how libraries operate in the future. This breakdown is important because at first it might seem that changes in technologies which support the day-to-day running of a library would determine the direction in which libraries develop. However, libraries exist to serve communities (general, academic, industrial, business, etc.) and, consequently, any changes in those communities must be reflected by some change in the library or the service it provides. Communities can change in terms of their information needs, their information seeking behavior, their use of information. Libraries can change in terms of the information stored, their interaction with the community they are serving - both level of interaction and mode of interaction, and their internal operation. Because of this service perspective of library activity, the characteristics of the library-of-the-future will be more critically dependent on changes in its most immediate external environment than on changes in internal operation. The technological trends in each of the two environments, internal and external, are described below and related to the activities identified in Figure 3.

3.1.1 Internal Library Environment

The internal activities of public libraries which have taken advantage of technological developments in the past were described in Chapter 2. They correspond to the traditional functional areas of

- acquisitions
- cataloging and catalog production
- circulation control
- serials control
- reference

The current trend for development of library automation systems is total integration. The achievement of a totally integrated library automation system revolves around the concept of a master bibliographic file. A truly integrated system implies that information to be stored is only input once even though it is used in many ways, and that system wide functions such as monitoring, authorization control, indexing, sorting and searching are implemented only once.

No fully integrated library automation system is available today. Systems do exist which integrate some functions (mainly cataloging and circulation). Other systems perform multiple functions but are not fully integrated in the sense of having a master bibliographic file. Systems currently being developed for full integration include the Integrated Library System (ILS) of the Lister Hill National Center for Biomedical Communications, CLSI's LIBS 100 system, and Sigma Data's DATALIB, Washington Library Network's WLN and the Dataphase system. Nevertheless, fully integrated systems will not be operational for a number of years.

An interim solution for internal library collection management and control is the use of a bibliographic utility, such as OCLC* or RLIN*. Originally developed as cataloging utilities, both have expanded their range of services and now offer acquisitions modules and permit the placing of interlibrary loan requests.

The functional area in which public libraries seem to be lagging behind (in terms of applying new technology) is reference services. As mentioned in Chapter 2, the introduction and development of online bibliographic databases during the late 1960s and 70s considerably enhanced the reference services that could be offered. However, the use of these online databases is considerably greater in academic and special libraries than in public libraries. Recent developments in online databases which are built and maintained outside the library are discussed in the next subsection.

One potential application of technology to reference service is the generation of an in-house database to support the reference librarian. The feasibility of such a system was demonstrated by Bivins and Palmer[6] with REFLES (Reference Librarian Enhancement System). Based on a low-cost microcomputer system, REFLES was designed to handle information not readily available in printed sources, but which librarians would have from past experience. It provided a tool for formalizing an individual's memory bank. This concept of allowing librarians to record and update "chunks" of information which they consider will be useful, and then facilitating retrieval of that information by means of a simple structured interaction between system and user, is not entirely new. During the early 1970s, the Computing Division of the National Physical Laboratory in England experimented with an "Online Notebook". This project placed computer terminals in selected laboratories of NPL which were connected to an on-site computer. The researchers were asked to use the terminals to record ideas, results and comments rather than jot them down in a notebook inaccessible to anyone else. The aim of the project was to provide the researchers with access to the previously unformalized thoughts and ideas of colleagues. The resulting "database" was used heavily at first but after considerable growth, it became more and more difficult to retrieve useful information. The project ultimately failed by not providing structured access to the database, through some form of subject indexing.

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*See Glossary.

The REFLES project did incorporate subject indexing and a highly structured hierarchical search mechanism. It was also the first attempt to apply the concept of an electronic notepad specifically to libraries. The main problem was the constraint on database size incurred as a result of using a very small, low cost microcomputer. As microcomputers continue to become more powerful at a fixed cost, and as the large capacity hard disks become available for microcomputers, the REFLES type of reference tool will become a useful complement to the more traditional reference materials.

3.1.2 External Library Environment

As mentioned earlier, the technological environment external to the library is expected to have a more significant effect on the future of the library than changes to the internal environment. There are two external groups that are rapidly investing in new technologies and that are likely to extend considerable influence over the direction in which libraries will develop. They are:

- publishers and database producers
- library users

3.1.2.1 Publishers and Database Producers

This section describes technological advances involving several aspects of publication and database production insofar as they will effect changes in libraries. The advances relate to both primary and secondary literature publishing and a variety of database types (bibliographic, full text, numeric, graphic, etc.).

The publishing industry has been fairly quick to take advantage of new information technologies primarily for document preparation. The most frequently used technologies are word processors and text editors. Such devices have already achieved widespread use. The proportions of articles prepared electronically for publication are projected in Table 1 .

TABLE 1 . PROJECTIONS OF ELECTRONIC PREPARATION OF ARTICLES, 1975-1985

	1975	1977	1980	1985
Word Processing	25%	30%	35%	50%
Text Editor	15%	17%	20%	30%

SOURCE: King, D.W., McDonald, D.D., & Roderer, N.K. Scientific Journals in the United States: Their Production, Use and Economics. Hutchinson Ross Publishing Company, Stroudsburg, Pennsylvania, 1981.

In 1980 it is anticipated that about 55 percent of articles will be prepared electronically, mainly by the author (or the author's clerical support staff) and that by the year 2000 just about all manuscripts will be prepared in this manner and transmitted to the publishers in digital form.

Word processors are essentially special-purpose microcomputer systems, dedicated to the preparation of documents of various types - letters, memos, forms, manuscripts, etc. They are systems in that they comprise a number of interlinked components. Most of the word processing systems available today include the processor itself (the central processing unit, CPU, of the computer which is based on microelectronic circuitry), some form of storage, a keyboard, video display unit, and a printer. These systems enable text to be input, corrected, reformatted, stored, retrieved, displayed and printed in a variety of ways. Most have minimal graphics and arithmetic capabilities - just sufficient to allow statistical tables, basic statistical analyses, accounting, flowcharts, etc. to be produced. In some specialized areas, more sophisticated graphics are becoming available, for example in the input of complex chemical structures in diagrammatic form, or the input of mathematical symbols and formulae. Such systems are geared for use by those unfamiliar with computer systems and, after an initial training period of 3-5 days, are very easy to use. In fact, some of the systems come equipped with a teach-yourself training package in the form of floppy disk and hard-copy user manual.

Text editors are very similar to word processors in that they fulfill the same function. Text editors are made up of the computer programs that are used to manipulate the text (i.e., a software package) and are usually run on a general-purpose computer. Because they form part of a more general system, they are not as tailored to the non-specialist environment as word processors. Most microcomputer systems available today have some text editing capability associated with them.

The storage associated with word processors and, in fact, with microcomputers running text editors comes in two forms. As with all computers, there is a certain amount of *internal* memory (often referred to as primary storage). This internal memory is used for manipulating sections of text and performing fairly straightforward calculations. The size of the word processor is measured in terms of the amount of internal memory it has, i.e., a 32K* machine has 32K of internal memory. The internal memory stores the programs that are used to manipulate the text and perform calculations. These programs can be used but not modified or enhanced by the operator. Several types of internal memory exist. They include ROM (Read Only Memory) and RAM (Random Access Memory). ROMs cannot be changed by the user and typically store system programs which are provided with the equipment, such as routines for sorting; adding, deleting or modifying text;

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*K stands for Kilobytes (1000 bytes). The actual size of a byte varies from one machine to another but can be thought of as one character.

accounting, etc. RAM, on the other hand, is used to store user-defined programs or user-entered data and therefore can be read from, and written to, by the user. The other type of memory is *external* memory or secondary storage which is used to store the text that is being prepared. The most common form of secondary storage associated with word processing systems is the floppy disk or diskette. These are small (5 1/2 or 8 inch diameter) flexible disks which hold information in the form of magnetic recordings. An alternative form of secondary storage which has recently become available for use with word processors is the hard-disk (also known as Winchester disk) technology. These are considerably larger than the floppy disks and are more reliable, being less sensitive to environmental conditions. The relative capacities of these forms of secondary storage are displayed in Table 2.

TABLE 2 . CAPACITIES OF ALTERNATIVE FORMS OF SECONDARY STORAGE

	No. of Characters	Average No. of Pages
Floppy Disk		
5 1/4"	Up to 1/2 M byte	180
8"	Up to 1 M byte	360
Winchester Disk	Up to 80 M bytes	30,000

These various forms of secondary storage could become the predominant medium for transportation of textual material. However, this transportation medium is likely to be superceded by digital communication channels. Word processors have two basic modes of operation. They can operate as stand-alone devices in much the same way as the typewriter (one machine per operator) or, they can be configured as shared logic systems allowing several operators, each with his/her own keyboard, local storage, and display unit, to share the processor and printer(s). With the shared logic set-up, documents can be transferred electronically through various communication lines. More recently, such systems have been equipped with remote communications capabilities enabling texts to be transferred over large distances. This capability has become known as electronic mail. Traditional electronic mail systems make use of coaxial cable for distances of up to 5 miles, and existing data networks such as TELENET, TYMNET or ARPANET, for long distance communications. The increasing availability of word processing and text editing equipment, together with electronic mail, leads us to the notion of electronic documents.

The concept of electronic documents has been discussed and developed for many years. The main debate in the literature appears to be the timescale within which electronic documents will totally replace the more traditional form-paper and microform. The earlier literature implied that the changeover would be complete by the year 2000 , but a recent study[33] made the following forecasts:

- By the year 2000, 50 percent of existing indexing/abstracting services will be available only in electronic form. The 90 percent level of conversion will not be reached until later.
- Existing periodicals (in science and technology, social sciences and the humanities) will not reach even the 25 percent level of conversion until after 2000.
- By 1990, 25 percent of existing reference books will only be available in electronic form. The 50 percent level of conversion will occur only after 2000.

- By 1995, 50 percent of newly issued technical reports will be available in electronic form only. The 90 percent level will be reached after 2000.

On the whole, it appears unlikely, in the forseeable future, that we will see the total replacement of non-electronic publishing with electronic. However, some documents will continue to be produced in several forms (e.g., abstracting and indexing publicationswhich often appear in paper, micro- and electronic form). In addition, some publications will probably appear only in electronic form (e.g., Computer Human Factors, an experimental electronic journal published by the British Library, or various data bases which never had printed counterparts).

The transfer of electronic publications, either from publisher to library or between libraries, will be accomplished using digital communications. The transfer of other forms of publications poses more of a problem. However, significant advances are being made in the area of document delivery systems. The most recent developments have been in the area of satellite communications (again digital). An experimental document delivery service based on satellite was evaluated in a National Science Foundation project[35]. A recent move by a consortium of European, scientific, technical and medical publishers is to set up a document delivery service for the distribution of separates (single articles from journals)[50]. Initial plans include the use of satellite communications and digitally encoded optical disks.* Paper copies of journals would be converted into digital form by some type of optical scanning device. These devices move across a page stopping every few thousandths of an inch to record, on the optical disk, whether or not a mark is detected on the page at that point. The recordings form a digital representation of the contents of the page which can then be transmitted and reconstructed at the destination. In the case of this planned system, transmission would be via a satellite, enabling documents to be sent over tremendous distances almost instantaneously. The particular issues that would arise if such a system became operational will be discussed in the second part of this chapter. If the scanners could be built with sufficient resolution, they could, ultimately, be used to scan microforms also. However, this is not likely in the near future.

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*For a detailed discussion of optical disks, see p. 41.

It is clear that publication methods are beginning to change. Devices which create digital representations of text are becoming much less expensive as a result of advances in microelectronics. The digital versions of texts can be fed directly into automated composition equipment if printed versions are required. The more publishers use these new information technologies for recording and transportation of texts, the more publications will be available in electronic form only. Libraries, traditionally stocking primary materials (books, reports, serials) mainly in paper form, occasionally in microform, and more recently in other forms (audiovisual materials) will have to be able to make electronic versions available also. The library of the future may receive a large percentage of its orders on a single disk, or else as a digital stream transmitted along the "public information network" (a digital version of the public telephone network but capable of transmitting all forms of message in digital form). A third alternative would be to receive a miniature memory component which could be plugged in to a microcomputer or terminal or TV.

As mentioned above, the form in which library holdings are stored will largely determine how they are distributed, and the form in which they are stored will, in turn, depend on the form in which they are published. However, it is highly unlikely in the forseeable future that we will witness the wholesale replacement of one form by another. The new and improved storage technologies that are potentially applicable to libraries are videodisks and microforms. Microforms have been used in libraries for many years now, yet never reached the levels of use predicted when they first became available. Part of the problem was the lack of low-cost, portable readers and the quality of reproduction. It is felt by some that improved resolution and reproduction techniques will result in widespread use of microforms in the near future. However it is probably more likely that we will see the replacement of microforms by electronic storage media, although not until the process of converting from paper form into electronic form is sufficiently low in cost to warrant its widespread adoption. The alternative ways to achieve the conversion are keyboarding or scanning (digitizing). Keyboarding is expensive, and increasingly so, because it is a labor-intensive operation. Scanning is still a relatively expensive process, as high resolution equipment is largely experimental. Public library budgets are tending to shrink rather than expand, and costs will have to fall significantly before scanning equipment is common in public libraries. Some machines, such as the Kurtzweil Reading Machines, designed to convert printed text into speech thereby providing the blind and partially sighted access to printed literature, are becoming a more frequent sight in public libraries. Machines that convert the printed word into a coded set of electronic signals are rarely seen.

The role of the videodisk in the libraries of the future has been discussed in detail by Barrett[2] and Goldstein[20]. Two different types of videodisk technology have emerged: the optical *digital* disk, which digitally encodes information and is used for computer mass storage, and the optical *video* disk which uses a standard video (filming) format for encoding the information to be stored. The optical video disks currently available can share 54,000 frames per slide. However, this does not mean that we can film 54,000 pages of text and store them on a single side of a videodisk. These disks are designed to be played back through a television set. The resolution of such sets is too low to be able to reproduce a legible page of text stored on the disk. However, this technique has been used in the development of the Video Patsearch system*pioneered by Pergammon International. This system provides online access to over 700,000 U.S. patents issued since 1971. The system consists of a microcomputer-based display terminal, a DiscoVision videodisk player and a set of 8 videodisks. The terminal is used to search two databases: one contains patent abstracts and other textual material (on the Bibliographic Retrieval Service, BRS), the other contains drawings and illustrations from the patent documents and is stored on the videodisk. This system has demonstrated the potential for using the video formatted disks, and the potential for integrating different forms of databases stored in different formats. As the recording and display processes are enhanced, more systems of this type will appear (see also p. 49).

Nevertheless, the public library might, in the near future, make recorded videodisks available to the public. The majority of commercially-available videodisks were developed by the entertainment industry. The recorded disks cost between $5 and $25 and players cost around $750.

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*See Glossary.

Recently, more intelligent players have been developed. Such players contain a microprocessor which is programmed to provide access, by frame number, to any single frame on the disk. Additional features include:

- freeze frame (stop on any single frame)
- single step (advance 1 frame at push of control button)
- slow motion
- high speed forward and reverse

The controller is usually a remote, hand-held device much like remote controls for TV sets. This type of intelligent player retails for about $3,000.

The main reason for the domination of the videodisk market by the entertainment industry is the high cost of recording the master disk, which must, therefore, be reproduced on a large scale to recoup costs. Currently, the costs for creating a master disk can vary between $2,000 or $4,000 (or even more in some instances) per side. The cost of reproduction is dependent on the number of copies ordered and ranges between $10 per disk, and $2 per disk for orders of 10,000 or so.

The technology for producing videodisks can be further exploited by encoding digital information on the video signal as indicated by Kenney[26]. Although Kenney discussed the potential for the storage and retrieval of digital information on optical video disks back in 1976, there are still a number of serious problems to be solved before the techniques can be applied in a production environment. One of the key problems is in the detection and correction of errors.

These errors can be caused by the recording process, the replication process, or imperfections in the disk surface material. A second problem relates to the 54,000 frame constraint. If the display is under some form of computer (most probably microprocessor) control, then the computer must have access to an index to the 54,000 frames.

The advantage of using the basic video format for digital information is that digital and video frames can be mixed. The digital frames can contain textual, numeric or audio information. The index, referred to above, should describe the type of information that has been encoded so that it can be output to an appropriate device - a printer for textual and numeric, amplifier and speaker for audio, and a TV set for video.

The Lister Hill National Center for Biomedical Communications of the National Library of Medicine has initiated a research program to electronically scan paper documents and film media containing a mix of textual and graphic information. The scanning and digitization process will be followed by a compression process (using compression ratios of up to 20:1). It is estimated that a single videodisk could hold the equivalent of over 500,000 pages. Such techniques, when perfected, could be used to store monographs (retrievable by title, chapter or section) and journals (retrievable by individual article or issue).

Optical digital disks differ from digitally encoded optical video disks in that the digital signal is directly recorded onto the disk. The optical digital disk is connected to a computer which produces the digital signals. The recorded information can be read immediately after recording to enable very fast error detection. These disks are able to store one billion characters per side.

Recorders and players for optical digital disks are not yet commercially available. However, Philips,* who developed the techniques, expect to make the recorder/player available in 1983 for $25,000, and disks for $250 each (in quantities of 100) . Philips is also extending the concept of electronic archiving with a project named Megadoc. This project is primarily concerned with the development of input and output devices which can be linked to the optical digital recorder for document handling. Finally, the Megadoc system contains not one disk, but a "jukebox" of probably 128 disks to expand the database capacity.

The potential use of such disks for information storage and retrieval is in the direct recording of text on to disk at initial keyboarding. As publishers increasingly use word processing and text editing equipment, the likelihood of optical disk applications will increase. Barret's recommendations to the British Library[2] can be summarized as follows:

(1) It is important to evaluate the potential application of optical disks now.

(2) The applications most suited to optical disk technology are database storage and storage of journal articles or reports for retrieval on-demand.

(3) Local and remote retrieval capabilities should be investigated.

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*See Glossary.

Public libraries in the U.S. should have similar concerns. The issues concerning the development of new forms of storage and distribution of materials are addressed in the second part of this chapter (see p.62).

A number of developments are underway in the area of machine-readable databases and mechanisms for accessing them. Database searching as part of a library's reference service has not been adopted as rapidly in public libraries as in academic and special libraries. There are several reasons for this.

The first online databases were scientific and technical, and therefore fell primarily within the domain of the academic and special libraries. Today many more databases are available (over 500) and cover many diverse subject areas from science and technology to the social sciences and humanities, to general knowledge. A second reason for the slow use of online databases by public libraries was the cost to provide access. The information requirements of the general public are so broad that to offer an online database search service would require the use, over time, of many different databases. The cost of training a reference librarian to access many databases is very high. Yet another reason is an inherent resistance to adoption of new technologies (this is discussed at length in Chapter 4).

A number of factors will increase the use of online databases by public libraries from now on. One is the increasing exposure of librarians to automated systems. Previously, the larger public libraries which could afford some level of automation for internal operations, such as cataloging or circulation control, also tended to be the ones to exploit online database search services. We might presume, therefore, that availability of funds and exposure to automation are factors likely to encourage online database use. Current trends in the computer industry will improve both factors. The costs of computer hardware are falling dramatically. Associated with an increasing availability of small but powerful computers is the increasing availability of software products. So the library automation trends of the 1970s, described in Chapter 2, will accelerate into the 1980s through the application of microcomputers and related software. More and more libraries will be able to automate at least some of their operations and librarians will become more familiar with interacting with computers.

Another key development which will encourage more public library use of online databases is the possibility of using the same computer terminal for remote access to a cataloging utility, such as OCLC or RLIN, as to database services, such as BRS or Dialog or SDC. Thus libraries with access to the cataloging utilities can access other remote services.

In the near future, we are likely to witness significant improvements in the amount of effort required to interact with remote online databases. The problems, which are particularly applicable to the public library situation because of the very broad information requirements of its patrons, of accessing different databases on different retrieval services have been discussed in detail[22]. Some of the problems can be alleviated to the extent that the differences in searching techniques required by the various search services can be minimized. One approach is to develop and implement a common command set*. Such a set has been implemented by the European Economic Community (EEC) for their bibliographic information retrieval network, EURONET-DIANE. Their Common Command Language, CCL, is a minimum set of commands required to retrieve bibliographic information online. They are defined in Table 3.

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*A command set is a set of rigidly formatted instructions by which the user controls the sequence of automated events.

TABLE 3. THE EURONET COMMON COMMAND SET

BASE	to identify the database to be searched
STOP	to end a session or part of it
FIND	to enter a search statement
DISPLAY	to display a list of search terms
SAVE	to save a search statement for later use
SHOW	to display or type records on-line
PRINT	to print records remotely
DEFINE	to override default parameters
DELETE	to delete statements or requests
MORE	to display more data
BACK	to display previous information
HELP	to obtain guidance on-line
NEWS	to obtain latest information on system
INFO	to give general information on aspects of service (with specific sub-commands)
OWN	to allow use of original commands.

The CCL does not restrict the user to those commands only. At any time, the user can interact with the remote database using the host service command set, and thus make use of some of the unique and more sophisticated search facilities that are available. The CCL is most useful for searchers who are unfamiliar with the service they need to use. The CCL in Europe also helps to overcome the problems of multiple languages which arise when offering services from many different countries.

Another approach to achieve the same end is the placement of an intelligent interface between the user and the system, in the form of an intelligent terminal (a terminal incorporating some electronic storage and pre-programmed functions) or a microcomputer. This is the approach taken by Williams and Preece[60], Marcus[40] and Williams[61]. The interface is designed to facilitate the user/system interaction, usually by a question-answer format. Extensive help messages can also be built-in to aid the novice user. So far, such interfaces have been largely experimental. Phil Williams has produced a device, available for about $1,500, which stores a search procedure (a sequence of fully formatted commands) and will subsequently dial the retrieval service and input the procedure automatically.

Such interfaces require further development, but the searching of online databases should become easier, and training requirements will tend to decrease. The decrease may not be as rapid as one might expect because new databases, new database types and new database services are continually appearing. Yet these new, easier-to-use systems are potentially self-supporting, in the sense that the systems themselves can be used to train people to use them. Computer-Aided-Instruction (CAI) has been an area for experimentation and development since the early 1960s. Computer software for educational and training purposes is now highly sophisticated and complex. Consequently, it relies on powerful computing equipment. Today, as a result of microelectronic technologies, CAI programs can be incorporated into smaller, less expensive computers. For example, most commercially available word processing equipment includes some form of CAI to train operators. In the future, we could envisage receiving a CAI program on a floppy disk or a plug-in memory module as a standard part of the subscription to an information service.

So far, we have discussed developments which are likely to improve the way public librarians will *access* online databases. Another series of developments relate to the future *content* of databases.

The online databases most often used by librarians were developed originally to generate printed indexes to scientific and technical literature, and contained bibliographic information (author, title, publisher, date, subject terms, etc.). Soon after, abstracts were added to the bibliographic record to enhance the descriptions of the literature. Until very recently these bibliographic databases containing abstracts were the predominant type of databases accessed by the library community (both in online and printed format). Advances in database technology and the emergence of database management systems have resulted in the growth of the numbers of commercially available numeric (financial, economic, statistical, etc.) databases.

In recent years there has been tremendous growth in abstracting and indexing products and services in the U.S. King Research estimated that the cost of abstracting and indexing in the U.S. of journal articles come to $50 million annually. This cost involves preparing over 150 databases with about four million articles indexed and abstracted. Martha Williams has estimated that there were four million online searches in the U.S. in 1979 and the number is thought to be about 6.5 million in 1981. The cost of the scientific and technical portion of this is about $170 million. King Research estimated that about 150,000 scientists and engineers conducted online searches in 1977. Nearly five times as many of them did searching of numeric data bases.

Another kind of database has also been developed in recent years known as knowledge bases. An example is a system being developed by the Lister Hill National Center for Biomedical Communications of the National Library of Medicine (NLM). They are developing a prototype computerized information system that will contain substantive answers to questions posed by practitioners, provide answers that are current and that are the consensus of a group of experts, be immediately responsive to inquiries at varying levels of detail, and provide data supporting the answers as well as citations to primary publications for more detailed study if desired. The disease "viral hepatitis" has been selected as the initial test model, and a knowledge base suitable for automated search and retrieval techniques has been constructed. Knowledge pertaining to aspects of viral hepatitis important to the practitioner and/or academician has been synthesized using the information contained in several reviews on the subject previously published by hepatitis experts. Relevant information has been selected, placed in a highly organized hierarchical arrangement to permit easy retrieval, and encoded into a mini-computer. Procedures for updating have been developed and the knowledge has been made available on an experimental basis to health care practitioners at selected test sites.

Possible future developments include the extension of existing bibliographic databases to include the full text of documents rather than abstracts (this already exists when texts are relatively short, as in newspaper articles, or highly structured, as in legal documents). The storage problems previously restricting the length of a bibliographic record can be overcome by utilizing the optical disk technologies described earlier in this chapter. A more distant development is in increased capability to search databases using natural language. The language with which we interact with machines has considerably improved over the last twenty years but is still a long way from natural language. It is possible that we will see inquiry languages very close to natural language for very narrow, specialized subject areas. The achievement of full natural language searching capability would seriously affect the role of the librarian as an intermediary between system and user, but is so remote that it will not be considered further.

In summary, public libraries will be affected by ongoing changes in publication of books, reports, journals, abstracting and indexing bulletins and in the production and modes of access to online databases. The new forms in which some of these materials will be produced, for example on optical disk, will force libraries to change accordingly. It is anticipated that, although there will not be one single form for all these materials in the forseeable future, the proportion of items available only in electronic form will continually increase.

3.1.2.2 Library Users

There is a tremendous amount of activity by the general public involving the application and use of new technology. These activities were initiated in two areas, in particular:

- entertainment
- home computing

However, as familiarity with the new technology increased in each area, the boundary between them became less distinct and new forms of information systems were created.

The entertainment industry developments were originally based on video technology - the recording of video images on optical video disk for replay by means of a video disk player and TV set. Pre-recorded disks of popular movies were available for sale and stores specializing in video equipment and recordings became a familiar sight. Soon, intelligent disk players came on the market. These gave the viewer control over the disk, through a remote hand-held device, in terms of speed and direct access. Features included the ability to freeze the picture on a single frame, step forward one frame at a time, high speed forward and backward, and direct access to a particular frame identified by frame number (hard copy index provided).

The industry is growing very rapidly and is projected to continue in a similar fashion as indicated in Figure 4.

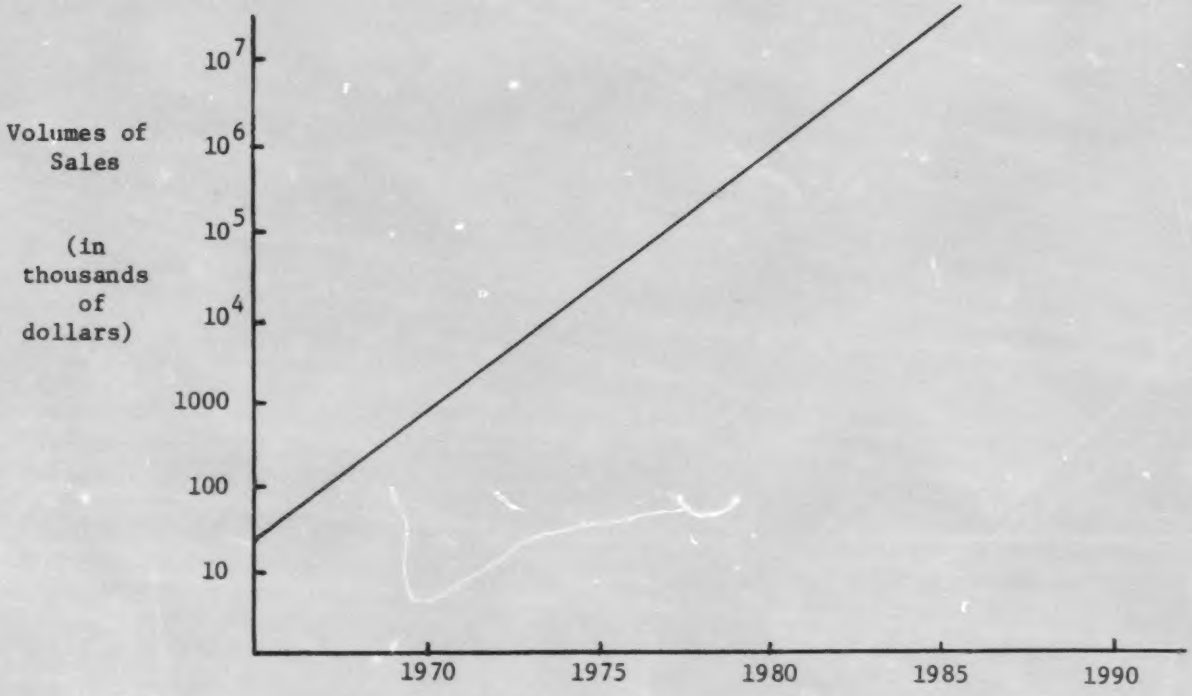

Figure 4. Growth of Entertainment Industry

These new videodisks are essentially no different from phonographic disks and films. It is, therefore, to be expected that public libraries will handle them in some way as they do other audio visual materials, stocking not only the materials but also the equipment necessary to hear and/or view them.

The microcomputer applications were also initiated from within the entertainment industry. The first microcomputers were marketed as personal computers for hobbyists and enthusiasts. They came in kit form and required at least a technical bent, if no actual technical knowledge. The first machines were not very sophisticated and had to be programmed in machine code* - a skill which at that time (mid 1970s) few computer programmers had. However, the development of newer, more sophisticated and more powerful microcomputers accelerated at such a tremendous rate that it was extremely difficult to keep abreast. The media played its part and the phrases "small is beautiful", "chips with everything", "silicon chips" became household terms. As a result of all this heavy marketing activity, two distinct product lines evolved.

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*See Glossary.

The faster growing product line, in terms of consumer purchase, was the computer game. These are basically very small microcomputers which are used in conjunction with a TV set. They come with a controlling device (which could be in the form of a dial, or joystick, or keypad much like a calculator) and a series of pre-recorded game modules usually on cassette. The basic game sets cost $500 with game modules averaging $15 per module.

The other product line was the home computer. These are complete microcomputer systems which come with a CPU*, keyboard, storage (floppy disk or cassette), visual display unit (in some cases this could be a TV set) and, optionally, a printer. As the microcomputers became more powerful, better and more sophisticated software* became available. Programming in machine code was no longer required.

The trend, over the last few years, of increased capability and sophistication accompanied by falling prices contributed to the widespread adoption of both types of product. As a result, some interesting sociological changes are taking place. Increasing proportions of school-graduates are computer literate.

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*See Glossary.

A number of education authorities around the U.S. have initiated microcomputer programs in high schools and, in some cases, in elementary schools. Thus public library users are going to become increasingly sophisticated in their information handling practices, many of them familiar with searching and manipulating databases online. The library should be flexible enough in its operation, and in the nature of the services it provides, to cope with the evolving needs of its user population.

There are two ways in which libraries can serve the microcomputing needs of its patrons. The first is by collecting and distributing software for microcomputers. The software packages would be stored on cassette or floppy disk and could be indexed by type (word-processing, accounting, CAI, games, etc.) as well as by the hardware required to use it (Apple, Northstar Horizon, Radio Shack, etc.). The second way that libraries can serve microcomputer users is by making microcomputing equipment available for use in the library, in much the same way as public libraries today often provide access to typewriters. However, if this second type of service were provided, at least one library staff member must be very familiar with the equipment, in order to help when problems occur.

The increasing exposure of the general public and of school children in particular to interaction with some form of automated system has led to the development of two new forms of information system. These systems are accessed through an adapted television set although the services they provide and the underlying technologies differ. *Videotex* (sometimes called viewdata) is an interactive medium linking relatively large computer databases to televisions through the switched telephone network. The United Kingdom, France and Canada are developing systems of their own and are selling the technology to other nations.

A variety of Videotex systems exist but they all operate in basically the same way. To access those messages transmitted via the telephone network, users must have special decoders built-in or attached to their television sets. To connect to the central database the user must first dial the appropriate telephone number and place the receiver in a modem or acoustic coupler. When the connection has been accomplished successfully, an index page appears on the TV screen and users begin to search for the information they require by pressing numbered keys on their hand-held control panel (the keypad). Instructions appear on the screen telling the user which keys to press for particular types of data.

The central Videotex database may contain an almost unlimited amount of information provided by sources ranging from local newspapers to travel agents, shops and libraries. The data are stored in "frames" or screenfuls and can be updated instantly. Several frames of information on the same topic comprise a "page" and may be accessed sequentially.

To retrieve information from the database, the users employ a "tree structure" search-method, starting with broad subject headings and narrowing down their choices until they arrive at the frame of information they require. Such systems, as currently designed, are fairly limited in capability and have no cross-referencing.

Unlike Videotex, *teletext* is a non-interactive system linking the information provider to the home via a regular or cable TV broadcast signal. Once again, only TV sets with special decoders are able to pick up teletext. Pages of information are broadcast, one at a time, in recurring cycles. To access them, users consult a contents page, then use the keypad to key in the numbers of the pages to be retrieved. The decoder then selects the appropriate pages when they cycle by and the information is displayed on the TV screen.

Teletext's chief virtue is its ability to be updated continuously for a large viewing audience. It can provide users with the most current information on a range of subjects and is easily accessible. Because it is broadcast rather than telephone-based, teletext is also less expensive than Videotex which requires users to pay for the telephone service and for each individual frame accessed.

Teletext has disadvantages, the greatest being its limited database size. To access information, users have to wait until the specific page they are seeking cycles by, giving the decoder time to read, decode and display the data. The wait time becomes excessive when the database exceeds about 100 pages. Thus, teletext is severely limited in the amount of information it can carry efficiently.

The public library can participate in the provision of these new types of information service in two ways. They can become providers of information - setting up frames of information on a variety of topics, such as library hours, new acquisitions, workshops, and children's programs. On the other hand, libraries can make Videotex and teletext available to the public in the library. A recent trial in the U.K.[25] demonstrated the success of both types of participation.

Related to these two new types of information service is cable TV. Public libraries have been particularly active in cable TV applications as they are considered fairly straightforward extensions of existing media programs. In addition, cable TV has offered libraries the opportunity to extend their information services to a broader audience, reaching not only traditional library users but also many non-library users, including non-readers.

Libraries can (and have) become involved at different levels ranging from the provision of basic information about cable TV to provision of an interactive cable TV service. Bradley[8] has defined 5 levels of library involvement in cable TV:

- Level I is the provision of basic information services about cable.
- Level II is the provision of video equipment for playback in the library. The library would collect and make available video programs from local and national sources.
- Level III involves the capability to produce video programs in the library or in cooperation with other local groups.
- Level IV is the use of cable channels on shared, cooperative or dedicated basis. This represents an appreciable advance over the three previous levels in which cable TV activities are essentially stand-alone. The installation of a cable

system for total or partial library use will provide access to all who are connected to it. Those residents without the cable service would be able to view the cable channel in library branches equipped with TV sets connected to the system.

- Level V is the incorporation of a two-way, interactive capability in which subscribers can react to programs, and even participate in some of them.

Today, many public libraries are involved with cable TV through the first four levels. The two-way capability is slower in its application in libraries, mainly because of the higher costs associated with its installation and operation. One exception, however, is the Public Library of Columbus and Franklin County in Ohio. The library has made use of the already in-place QUBE system (produced by Warner Cable). A monthly television program, the "Home Book Club", allows viewers to respond to discussion of current bestselling books. At the end of the program the viewers can participate in the selection of the next book for discussion and, at the same time, can request a copy of the book to be sent to their homes. Future plans for use of the system include the availability of the library's catalog online via cable.

Many public libraries have no cable system available in their area. Meanwhile, librarians are preparing themselves and the members of their community for the eventual implementation of local, regional and even national cable networks. The American Library Association's Video and Cable Communications Section has published a set of guidelines on video and cable communications for librarians.

Each of the technologies and their application in libraries and use by potential and actual public library users is able to expand the extent and range of information services provided by the public library. However, it is the combination of technologies, the merging of computing technologies with communications technologies, that will form the very sophisticated and powerful information systems of the future. In spite of the increasing capability of such systems, they will become easier to use and therefore be available to a broader group of users.

A particular example of this trend has been the considerably improved services available to the disabled community, as a result of technological innovation. The dissemination of information directly into the home via broadcasting (teletext), telephone (Videotex), or cable have given access to those previously unable to visit the library. With the introduction of interactive services such as Videotex and two-way cable, these patrons will be able to order books, magazines, records, etc. by electronic means and have them delivered directly to the home. The mode of delivery itself is likely to change, in the future, from mail to electronic depending on the form in which the materials are held by the library (which, as mentioned earlier, will in turn depend on the form in which the materials are received by the library).

Another development which has helped disabled people and, in particular, facilitated the education of the disabled, is teleconferencing. Teleconferencing utilizes recent advances in computing and telecommunications to structure, store and process written communications among groups of people. These texts can be transmitted using a number of different means depending on how the conferencing system was set up. Examples of alternative transmission types include cable (2-way, interactive), telephone, microwave, and satellite). The electronic mail services described earlier (see page 37) are one form of teleconferencing. Of special interest to the disabled are teleconferencing systems with video displays, known as videoconferencing systems.

Hiltz and Turoff[23] discuss the potential application of teleconferencing systems to the "disadvantaged" (both socially and physically disadvantaged). The conferencing concept gives the student all the capability for peer-group interaction which is lacking in the traditional home-tutor environment. With such a system, groups of up to 20 children at a similar ability level could share a single tutor, or groups of tutors specializing in different subjects. As well as interacting with the tutor the students can interact both formally and informally with each other.

Microcomputers are being used to help blind and partially-sighted people to make use of new forms of information systems, creating new employment opportunities for them and generally improving their 'quality of life'. Many of the innovations are initiated from within the disabled community itself although major computer manufacturers and ancillary software and hardware equipment suppliers have moved quickly to capitalize on what has been recognized as a viable market as well as a need to be filled.

The ORATOR system marketed by ARTS Computer Products, Inc. (founded by Peter Duran, a blind computer programmer) scans a word typed on a computer keyboard and, using about 300 rules to guide it, pronounces the word in synthesized speech. The synthesizer not only repeats the words as they are completed, but also sounds the individual letters as they are typed. Ultimately, the system will be adapted to read out any display (either keyed-in or received electronically from a remote location). A further application is the potential for the speechless to make use of the telephone networks by keying-in messages to the microcomputer which then "speaks" them into the telephone.

The Kurzweil Reading Machine (KRM)[59] is somewhat different in its operation although it too serves the blind or partially-sighted community. The KRM provides that community with virtually unlimited access to the printed literature. A document page placed on the reader is transformed into synthesized speech by an optical scanning device. Public libraries saw the opportunity to expand library service to the blind beyond the traditional books in braille or the so-called "talking books". In 1978 the first KRM was installed at the New York Public Library. Weinberg[59] discusses the reaction to the machine within the library and further projects that were initiated as a result of its installation there. Since 1978 many public libraries have installed Kurzweil machines, and it is hoped that, as the cost of electronic equipment falls, more libraries will acquire them.

3.2 New Technology Issues Concerning Public Libraries

In most of the above-mentioned technologies, the library can participate in two ways: by acquiring, storing, and disseminating new forms of material relating to the technologies (computer software, video programs, etc.) and by providing equipment (computers, terminals, interactive TV) to make use of those materials to those who either do not have access to such equipment at all or who need immediate access while away from their home or office. A number of serious issues arise concerning the future role of the public library in a partially and increasingly electronic environment.

In a discussion concerning the role of public libraries in the 1980s, Baker[1] claims that there are two *threats* to the public library system:

- technology
- shortage of funding

The threats are really threats to the current public library system which, if it is to survive, must change and evolve in response to its changing and evolving environment. Particular issues to be considered in the light of technological change are:

- education and training
- quality assurance
- ownership and copyright
- privacy and protection
- funding
- private and public sector relationships

3.2.1 Education and Training

In spite of the growing numbers of computer literates in the community-at-large, and the growing "user-friendliness" of user-computer interfaces, the

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installation, in public libraries, of equipment to provide access to the new forms of information systems and services requires that librarians be familiar with the operation of the equipment and systems. Training in traditional form is becoming increasingly expensive because it is labor intensive. To a certain extent, training can be conducted in a more cost-effective manner by CAI*packages which should be available as part of a complete system package (i.e., hardware, software, servicing training modules, manuals). Today, such packages are available only for a limited number of systems, e.g., word processors. Until they become more common, moves into some of the new technology areas are likely to appear prohibitive from a cost standpoint.

We must consider not only the training of working librarians to cope with a range of new equipment and systems but take a step back to the education of librarians and information specialists in library schools. The majority of library schools in the U.S. do offer introductory computing (mainly programming) and online database searching courses. A few offer courses based on small microcomputer systems. But few currently teach the student how to cope with breakdowns and problems, or how to organize and control new forms of materials, or how to be information providers generating information for inclusion in these new systems. In order to prepare for future generations of librarians, schools must be encouraged to adapt and expand their curricula to reflect the new types of activity their students may be engaged in. For example, some library schools in the U.K. offer courses in graphic design in which students learn how to prepare pages of information for optimal affect on Videotex and teletext systems.

In addition to the education and training of librarians, the availability of equipment within the public library requires that at least a minimal amount of

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*See Glossary.

training be available for its users. Librarians may well find themselves organizing seminars and workshops on the use of information systems, based on new technologies, for their patrons (who will access the systems from the library, from the home or from their place of work). If this happens, then public libraries need to ensure that they have the appropriate space available to accommodate groups of about 10 people. In this way, librarians will play an important role in the community by providing people with basic information acquisition skills.

3.2.2 Quality Assurance

The continual decrease in the costs of digital storage technologies, the potential for mass storage of information and databases on optical disks, the growth in the number and type of commercially available databases, the development of "user-friendly" system interfaces and the increasing ability of the general public to use information systems directly, all contribute to the problem of relevance. With ever increasing volumes of information more easily accessible, how can we avoid the potential for information overload? This issue has already become a concern for the information profession. For example, in 1975, Pao[46] proposed a method for selecting quality journal articles by using their citation frequency in review articles. Another method, being tested at the University of Southern California School of Medicine, is based on the presence of numeric displays in scientific journal articles. Neither of these approaches has a particularly sound basis (see Narin's[44] discussion on the strengths and weaknesses of citation analysis) but have been very useful in increasing awareness of the problems they are attempting to solve.

The general concept of quality filtering for bibliographic retrieval was first proposed by Etzioni[14]. His concept led to selection of journals, authors and papers of quality for any given subject area. Actually, quality filters already exist and have been in operation for a long time. The most obvious filter is the refereeing system employed by most scholarly journal editorial boards. However, different journals have differing refereeing policies, and the effectiveness of the refereeing concept is itself under scrutiny.

The filtering should not only occur at the journal publishing stage, but also at the abstracting and indexing stage, although if the first level of filtering is consistent and reliable, then down-the-line filtering would not be necessary. Two basic approaches to filtering can be taken. One approach is to only allow 'quality' material into the information system; the other is to store as much as possible but to filter at retrieval time. The latter approach tends to be preferred so that access to any particular item is never totally denied.

The Rockefeller Foundation in 1978 sponsored a conference[51] on qualitative approaches to coping with the biomedical literature explosion. The conclusions of the participants seemed to be:

- no changes to the current scientific communication system should be made until a better understanding of the processes involved are achieved

- there is need for more research into the complexities of scientific communication

- quality filters should be placed at strategic points in the system.

Very recently, King et al[30] developed an approach to estimating the value of information systems, products and services based on amount of use, and consequences of use.

So far, these approaches have been developed in rather formal information systems. The appearance of more and more informal and decentralized information systems raises serious concerns of management, control and even censorship (if public access is available) of information stored. In the interests of their communities, public librarians must be as concerned with machine-readable information as they are with printed and other forms of information.

Work has very recently been started on improving the quality of statistical databases and numeric databases[6,21]. The approach is based on the use of a faceted classification of data, coupled with a sophisticated data tracking mechanism and a hierarchical search method.

3.2.3 Ownership and Copyright

Issues dealing with copyright and intellectual property may be highlighted through use of new technology in public libraries in two ways. First, public libraries will continue to handle and process copyrighted materials and new technology will provide new means of displaying and/or reproducing the information that may have implications of copyright infringement. The issues concerning photocopying of copyrighted materials in libraries presents a much much more straightforward problem than that posed by information stored in digital form, distributed by telecommunications and displayed and/or reproduced electronically. The second set of issues involves information produced by public libraries that could be copyrighted.

The employment of new technology in public libraries could conceivably yield some problems in the future. The outcome could be merely to reduce extent or type of use of the new technology, or worse, it could result in long-term controversies that would tie up the full use of new technology for many years. Examples of potential problems are briefly discussed below. Some public libraries keep the output to online searches for further use by their patrons. Is the further use of the printed output by patrons other than the purchaser an infringement of the copyright? Will reproduction of video recordings be considered an infringement of copyright? The Betamax case* would suggest so. If a library captures a portion of an online search on an in-house minicomputer and provides further search, is that a copyright infringement? There are several issues involving use and resource sharing of computerized catalogs that may require copyright decisions. If a journal article is received by telecommunication, can it be reproduced for further use? The point here is not to suggest answers to these questions, but rather to point out that problems can arise concerning the use of new technology and copyright which might inhibit their full use. Future planning might take this into consideration.

It is felt that public libraries might serve as the source of input to some new systems such as Videotex. The reason for this is that public libraries may be the source for information used in these new systems and they may also have backup materials for persons that want more detailed answers than can be economically provided by digital storage. The point is that public libraries would then become the copyright owners and would be faced with the problem of potential copyright infringement by others. The reason for the concern is that infringers could capture the market for use of the materials and, therefore, result in a very high cost per use of the materials or services provided by the library. Again, this is not to suggest that such problems will occur, but that public librarians must be prepared to think about them in future planning.

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*See Glossary.

3.2.4 Privacy and Protection

One aspect of new technology that can be used in public libraries is to monitor the frequency of use of certain materials and services so that they can be improved. Much new technology with its storage capabilities and direct interface with users has the capability to maintain records of use for improving and fine tuning a system. The use of materials and services can be recorded and frequently used items provided in a better form, or organized to serve the user better. Infrequently used items can be treated in a way that is less expensive. For example, categories of inquiry of Videotex could be dropped or added depending on frequency of use; databases for online searching could be organized differently or added or dropped depending on extent of use; areas of computer-aided instruction could be deleted if infrequently used. Furthermore, selective dissemination of information capabilities could be employed which are tailored to specific users. Certain televised programs can now be varied according to viewers' desires or moods.

All of these capabilities can be provided by new technology which are quite beneficial. However, there is some danger as well because of the potential for invasion of privacy. By maintaining records of use or purchase by individuals, one might be able to damage them or their reputation in some way. Already, there is a land mark case involving use of books in a library in which an attempt was made to use circulation records to show what an individual was reading. This issue is one that could have significant impact on the ways in which new technology is used in public libraries and must be addressed as new technology is implemented in them. Another potential abuse of new technology is when the computer is used as an electronic message center or public bulletin board. In this case, young adults or others will probably input graffiti or some other forms of improper messaging. Also, there is always the potential for messages to be communicated to the wrong recipient by merely inquiring through random passwords. The point is that new technology will undoubtedly provide substantial benefits in the future but one must be aware of potential detriments as well.

3.2.5 Funding

One aspect of new technology presents a problem to library directors. Computers and other equipment cost enough that they are given as a line item on library budgets. This often raises a red flag because of the amount or because many city officials have been burned by purchases of computers in other local environments. Therefore, librarians often have to justify the expenditure or they must find alternative sources of funds. Another aspect of new technology that affects funding considerations is the relatively large initial expenditure for purchasing and installing equipment compared to recurring annual expenses or operational expenses. Funding sources will depend to a large degree on the type and purpose of use of new technology.

There are two general situations in which new technology will be employed in public libraries. The first way will involve technology used for library technical operations such as cataloging, circulation control, acquisition control and so on. The second way will involve new services provided to patrons such as online bibliographic and numeric data searching, Videotex services, computer aided instruction and any type of facilities that can be of service to public library patrons. Another aspect that will dictate funding mechanisms will be whether new technology information products and services are provided entirely by the local public library (or public library system) or by shared resources with other local libraries or regional networks. The new federalism program recently initiated by the Federal government will also determine to some degree how new technology might be funded.

It would appear that there are three sources of funds for the public library system. The first source is through local funds collected through taxes. The second source is through grants available through an intergovernmental grant system. The final method involves user charges for services provided by new technology. The latter method has been extensively discussed[18, 19, 10, 27] in connection with online bibliographic services and it will also be discussed briefly in this section. First, the funding through the block grant system will be briefly described.

The intergovernmental grant system was debated at length during a pre-White House Conference on Library and Information Services sponsored by the National Commission on Libraries and Information Science[56] There are three basic kinds of support mechanisms in the Federal grant-in-aid system: categorical grants, block grants and general revenue sharing. Library support up until 1982 has been provided primarily through categorical grants. The Federal role and funding of libraries, as a direct object of grants, began with the Library Services Act of 1956. That role was broadened and restated as the Library Services and Construction Act (LSCA) in 1964 and 1966. LSCA was reenacted and extended for five years in 1970 and again in 1977 in unchanged form, except for the addition of a very limited program to provide special fiscal support for urban libraries. As previously indicated, budget estimates submitted by the Carter Administration tended to extend LSCA support without any increase in the level of funding. Now it appears that the block grant system will be employed subject to negotiations between the Reagan Administration, Congress and state and local governments.

The current atmosphere concerning intergovernmental fiscal relationships has resulted from a high level of concern and considerable discontent with the existing Federal grant system. The central focus of the criticism has been on the tremendous increase in Federal dollars, the impact of Federal funds on the pattern of state and local expenditures and the decision making processes controlling those expenditures, and the administrative complexities which are an integral part of the present system. The specific target of most of these criticisms is the categorical grant which, along with block grants and general revenue sharing, constitute the Federal grant-in-aid system. Therefore, it is uncertain as to how much libraries can count on support from the Federal government to support acquisition of new equipment or for resource sharing activities.

It would seem that the potential consolidation of categorical grants will affect mostly those public library services now being funded by categorical grants and, particularly, the resource sharing of library operational functions, services and materials. Much of the new technology will be employed in such resource sharing networks including cataloging, interlibrary loans and so on. There is a strong possibility that library functions and services will be shared with other state and local government telecommunications networks, computer facilities and other forms of new technology. However, it is too early to tell how the new intergovernmental grant system will affect these services.

Because of the uncertainty of the first two sources of funds, public libraries are more and more looking to funds provided through income from user charges. This topic is discussed below from an economic viewpoint and some suggestions are given concerning factors that might be considered in determining whether public library services provided through new technology should be given free or charged for. Public libraries are suffering from severe economic pressures and have sought ways to reduce costs and/or to increase revenue. They are attempting to reduce costs through employment of new technology and resource sharing in library operations and by purchasing fewer materials. One way to increase revenue is through charging users for some services, particularly if they involve expensive new technology.

King[27] has discussed some of the economic issues concerning user charges which are given below. Two principal questions must be answered when considering charging for library materials or services. First, who should pay for these materials and services? This seems to depend, at least to some degree, on who benefits from them. Clearly, at one end of the spectrum is the possibility that direct users should pay because they are the principal beneficiaries. At the other extreme is the philosophy that society should pay for library services through taxes, since everyone shares in the benefits provided by libraries. There are many possible variations and options to consider when deciding who contributes to or pays for library materials or services. The second question is how much each contributor should pay. Economists have applied these questions to many kinds of goods and services. They begin by classifying goods and services into categories which help to clarify the economic issues involved.

The first category of goods is for a private good. This includes goods such as food or cosmetics which primarily benefit the individual purchaser. There are two principal conditions of private goods. First, a person can be excluded from purchasing this type of good by either the price or the limited supply. Also, purchase (or use) of these goods must deplete their supply (i.e., there is one less apple in the barrel) and there is a cost associated with providing each unit purchased. Generally, it is felt that the user (and principal beneficiary) of private goods should pay for them. At the opposite extreme is goods used for a public good. In a purely economic sense, public goods benefit an entire community or society. Examples are the air people breathe, public parks, national defense, and scientific knowledge. Presumably, everyone benefits from these goods or services, use does not deplete their supply (i.e., one person using a park does not deplete its availability), the cost of each additional use is zero, and no one is excluded from their use or benefit. Everyone in society can benefit by scientific discovery in some areas; therefore, one can argue that the costs of pure science should be shared by everyone through taxation.

Most library materials and services do not fall clearly into either of the above categories. A major reason is that most library materials and services involve scholarly knowledge or intellectual property that is recorded. It is important to distinguish between knowledge itself and the various forms in which knowledge is found, e.g., in the mind and in print[37]. Each form of information has a different set of economic conditions. Knowledge in the mind (although often funded by government), is not really a public good since it is exclusive (in the sense that a scientist or novelist can choose whether or not to reveal the knowledge) and it costs the scientist or novelist in terms of time required for communication. Yet knowledge in this form is nondepletive. When recorded in a manuscript, the information remains nondepletive; however, unless reproduced, exclusion still takes place due to lack of access to the information. Even though publishers incur substantial cost producing a master copy, the information lacks the nonexclusion condition for the same reason; however, the information comes closer to being a public good in this form. When the master copy is reproduced, the copies (not the information) become very much like a private good. Users can be excluded from purchasing copies of books or journals because of the purchase price or limited supply, each copy produced has a small (but nonzero) cost, and purchase of copies depletes the supply[27].

After the copies are distributed, an entirely different set of economic conditions holds. It can then be argued that materials found on the shelves of a public library are more like public goods, since they are nondepletive, each additional use has a cost close to zero, and the condition of nonexclusion is present. Exception to the last condition exists when a book is on loan, stolen, or when exclusion is caused by distance or hours of operation. If a photocopy (for personal use or interlibrary loan) is made of a journal article, it again becomes more like a private good: there is a cost associated with reproduction, and possible exclusion exists due to a charge or unequal access to photocopying equipment.

Another economic classification is merit goods. This includes private goods that are considered by some to be of such benefit that they should be supplied by the public. It is assumed that such goods would not be purchased if left to the ability or preference of potential purchasers. Examples include free lunches for schoolchildren, low-income housing for the poor, and free education for all children. The argument is that the advantages of a merit good are more apparent to the informed (i.e., an elitist, moral or pressure group with power) than to the uninformed general public, and therefore should be provided. Cooper argues that information is generally like education, and therefore should be considered a merit good[9]. However, he also points out that online search services do not fall into this category.

Another important economic consideration is the indirect effect of the use of goods or services. Often persons other than the original purchaser or user are positively or negatively affected by a purchase decision. Such effects are called externalities. The construction of an elementary school can have positive externalities because the building and its land can be used for adult education, business and recreational purposes that extend beyond its primary purpose of housing children's education. Each of these uses in turn yields a benefit to the community or society. An example of negative externalities is the purchase of large automobiles whose size aggravates pollution, hinders traffic flow, requires more parking space and uses more gasoline. The externalities of library materials and services vary a great deal. Use of scientific information may yield substantial social benefits, such as the cure or prevention of diseases.

On the other hand, information from a novel read for recreational purposes probably does not yield external benefits that are nearly as great. In all instances, the value of externalities is difficult, if not impossible, to measure[37].

The externalities associated with materials and services provided by public libraries varies substantially by the type of users involved. Public libraries serve a broad spectrum of patrons, including the general public, industry and the research community, and students and teachers from the educational community at all levels. They use public libraries for purposes ranging from recreation, education and scientific research to business operations. Thus, the direct beneficiaries are widely dispersed and the externalities derived from use of materials and services provided by public libraries are difficult to measure.

One aspect of requiring user charges is that they will affect the amount of use made of materials and services. King et al[30] make a strong argument that the value derived from information increases in direct proportion to the amount of use of the materials and services. The more that is charged, the less materials and services will be purchased and used, therefore reducing the value of the information. There is little question of the value of scholarly materials used in education, science, medicine and other professions. More use of these materials should yield substantial increased benefit to society. The same would hold, perhaps to a lesser degree, for information used for recreational purposes. The option arises of giving away all materials or services in order to achieve maximum use of them and thereby achieving maximum value or benefit from them. One of the principal arguments used against this is that the materials and services may be ordered or used for frivolous or unnecessary purposes. However, even without a charge for materials or services, the users will incur a cost in terms of their time (which can be substantial), and so they will not use materials or services as frivolously as implied by some. Generally, economists feel that maximum net benefit to society of materials and services is to charge a small amount, usually equal to the marginal cost of use or distribution.

It is important to make a distinction between information and new technology that adds value to the information through communication, display or some other function. The information may be like a public good but the property of new technology may be more like a private good. Certainly, this appears to be the case with online bibliographic services. Some factors to consider when deciding to charge for materials or services provided by new technology include who the users are, the cost of the materials or services, whether cost is incurred by the library for each use or is shared by all users, and whether there are other options available to the user within the library[12].

One factor that might be considered in deciding whether or not to charge for materials or services provided by new technology is who the users are. Cooper[9] discusses user charges for online searches provided by public libraries. He feels that professional users such as doctors, scientists, lawyers or businessmen should be able to pay for the service and a charge should not have much bearing on whether or not they will use the service. It is not argued that the use by this population is not beneficial to society, but rather that value would not be lost because extensive use would be made whether or not a charge is made. He also suggests that users who do not contribute to revenue through taxes, such as residents of another town, should pay for online services. Videotex users, on the other hand, are likely to come from all walks of life and, therefore, may have less ability or inclination to pay. Thus, substantial benefit in using the Videotex systems would be lost through user charges.

Another consideration in whether to charge users or not concerns the level of cost involved. If the cost is very low, the cost of the process of charging could be greater than the revenue derived through charges. Such a problem is taken care of in photocopying by using coin operated machines. Another important cost factor is whether a cost is incurred by the library for each use. With online bibliographic and numeric data searches provided by public libraries this is certainly true. Even though most public libraries refer searches to other libraries (usually academic)[36, 12], they are frequently charged for the search by those libraries. For searches performed in the public library, there are costs associated with equipment, labor, communication, connect time, database usage, and offline printouts and/or kits. Lynch[36] found that 72 percent of public library respondents to a 1981 survey charged online services. She found that most libraries charge for communication (60%), database usage (82%) and offline printouts (76%). Some public libraries charge for searcher time (21%) but only a few public libraries charge for annual costs (3%), overhead (10%) or other sources of costs (8%). It would seem that the fact that individual costs are incurred and private good is derived from use of this new technology would suggest some form of charge. Services such as Videotex are not quite as straightforward regarding this factor, however. In this case, the use may not involve a cost per use or at most a minimal cost per use, if an in-house Videotex system is used.

Another consideration is whether there is an alternative in the library to using the materials or service provided by new technology. Presumably, online bibliographic searches could be conducted through printed indexes, which are more like a public good. Thus, users have a choice whether to search by each means. They would trade-off the savings in their time for using the online services against a user charge, if it is assessed. Also, another alternative is whether users chose to use librarians to conduct the search instead of conducting the searches themselves. Videotex systems probably would not have comparable alternatives.

As Van House states, "A more subtle and perhaps more basic question suggested by libraries' experiences with online searching, however, is that of the role of the library in relation to future innovations in information technology. The growing importance of information in our society has resulted in the proliferation of specialized services that create, index, repackage, and deliver information. Many of these services have been made possible by developments in technology, which can be expected to continue to spawn new methods of information handling. What is the role of the traditional library in providing users with these new information services?"[12, 46, 42, 5] Regardless of what kind of technology evolves over the years, the question of user charges is likely to prevail.

3.2.6 Public and Private Sector Relationships

One outcome of the employment of new technology for user services in public libraries could be a conflict between the libraries and private sector organizations that also (or could) provide the same services. There is at least one instance where an online bibliographic broker has threatened to sue a public library for providing online bibliographic searches to the public. It is argued that public funds should not be used to provide a service that is already available through a private broker. There are two aspects to this issue. First, should a public library provide services that are available through existing private sector organizations? Second, is the library's user charge (or lack of it) unfair competition to the private sector? There are no simple answers to these questions, however there are some general principles that one might follow.

One general principle set forth by King et al[30] is that information is a valuable resource to the nation and every attempt should be made to encourage its use. The more it is used the greater its value. There are several factors that affect use of information including its price, quality, performance and awareness. Price of information should be thought of in terms of what patrons "pay" in their time and effort as well as monies exchanged. In nearly all situations, the amount of use varies inversely with changes in price. An increase in price yields a decrease in use and, therefore, a corresponding reduction, in value of information. Taking this to its logical conclusion might argue that a public library should not charge at all. However, economists have demonstrated that, in many situations, some minimum charge to recover reproduction and distribution costs yields the optimum net benefit to society. That is, the value to users usually exceeds the cost to the libraries above that point. Similarly, increased use and greater value can be achieved through providing higher quality information (where quality implies an improvement for the purposes for which information is being used such as entertainment, research, etc.). Greater value can also be achieved through better performance by the library and by making persons aware of the availability of information through bibliographic products and services, public relations and the like.

Some judgment must be made concerning the provision of information products and services through new technology and whether social value is increased or reduced by making them available through the public libraries. Clearly, in some instances, society can be best served through cooperative arrangements when price is low, quality high, performance better or awareness greater. The pricing issue concerning whether having no charge or low charges is unfair competition is a difficult question. Society is not well served when incentive to provide services through the private sector is stifled. Yet, the private sector could establish a monopoly and charge such high prices that the public is not well served in this way either. It is possible that some compromise will be carefully considered. The problem of public and private sector competition is likely to increase in the future with the advent of new technology in libraries. When this happens we should always think about the effect of policies or decisions on the benefit to society as well as other legal, political, administrative and social factors.

CHAPTER 4

RESISTANCE TO TECHNOLOGY

One of the most baffling of problems which planners face is resistance to change. Such resistance may manifest itself in a variety of ways, e.g., refusal to use technology, self-imposed decrease in productivity when using the technology, and lack of cooperation in implementing or using the technology. In the public library environment, resistance may potentially arise in two areas: among the librarians and among the library users. On the whole, the underlying reasons are similar - uncertainty, fear of loss of control, fear of unemployment as a result of the growing implementation of new technology (by the librarian in the library, and by the library user in his/her place of employment). Consequently, the steps that can be taken in an attempt to minimize resistance will be the same in either case.

4.1 Resistance to Technology in Libraries

Much of the literature concerning the resistance of librarians to technological change deals solely with the introduction of computers into the library environment. Myers[43] feels that existing documentation of librarians' resistance to technological changes is harsh in that few critics are willing to demonstrate a concern for the reasons underlying such resistance. Early reports either ignored the issue of staff reaction to technological innovations[15] or addressed the issue in rather condescending terms suggesting that librarians suffer from "feelings of inadequacy when confronted with supervising and contributing to an effort in automation" . In 1977, Martin[41] reviewed the literature relating to the impact of technology on libraries and librarians and discovered that only 9% of articles identified had any bearing on how or why librarians react to technological change. Few studies focussed on public libraries, concentrating rather on the academic environment.

While few specific studies concerned attitude to technology, some attitude surveys included questions about technology -- usually about automated library services. For example, Veaner[57] found that some librarians were "baffled, impatient or frustrated" by rapidly changing technology. He considered that such reactions emerged from feelings of threat to routine and stability, and fear of unemployment due to automation. Wasserman[58] perceived a general conservatism in the library profession, not as an active element, but as a passive acceptance of innovation without a willingness to implement it. Fine[15], on the other hand, states that "there is little doubt that libraries have made peace with the age of technology". It seems clear that the discrepancy of findings across various studies results from their having either concentrated on particular technologies (notably the introduction of online systems, or access to such systems) in libraries, or on particular types of library. Fine's study is certainly the most extensive and systematic. Turning to industrial environments for suggestions, she presents the following factors that help alleviate (but not necessarily overcome) resistance:

- information
- involvement
- support and reassurance
- guidance

- presence and proximity
- discussion
- clarification
- respect for values and dignity
- hope.

While these factors are identified, and reasons for resistance determined from the study, no attempt is made to address how one might overcome resistance, or at least minimize it in any practical sense.

Nielsen[45] has taken another viewpoint. He considers the interaction of technological change and a professionalization movement, within the context of librarianship and online bibliographic search services. Instead of referring to the studies mentioned above, Nielsen uses two examples to demonstrate the degree of technological resistance in library environments. The first example is the apprehension to technological innovation expressed by librarian participants at the 1977 American Library Association's President's Program[7] . Some of the descriptions used were uncertainty, fear, and exasperation over new technologies, library education, social change, and the future role of the librarian. The second example revolves around the whole user charging issue. The thrust of Nielsen's argument is that, in some respects, the technology (in this case, online searching) can appear to threaten deprofessionalization of librarianship. This is contrary to the more frequent view within the library or information community that technology is a professionalizing force for librarianship.

4.2 Overcoming Resistance to Technology

Overcoming resistance is a major problem in implementing changes in an organization. Unless resistance is dealt with adequately, the changes might be met with aggression, hostility, restricted production, and a lack of cooperation from those affected by the changes. Several authors[24, 34, 55] have attempted to address this issue by defining what kinds of measures that can be used to overcome resistance to change (these mostly have been applied to industrial environments). Some of the methods suggested include: employee (and user) participation in developing and implementing the changes, understanding the social aspects of the changes, developing a cooperative atmosphere between library management and those affected by the changes (i.e., the librarians and the users), fostering communication of what the changes are and the rationale behind them, and creating a general organizational attitude which will foster greater cooperation in the change process.

Employee participation in the changes involves a real effort by library management to include those affected by the changes in the actual development and implementation of the changes themselves. When the employees are allowed to help in the decision-making process, they will come to feel that the changes are not just management directives, but something they helped develop and want to see succeed. Employees will become "ego-involved" with the changes and will personally try to influence their outcomes. This approach is reflected in Chapter 5. Employee participation can also take place in the form of group meetings with library management or personal discussions between management and the library employees individually.

Another way of dealing with resistance to change is by understanding the social, not just the technological, aspects of the changes. The social aspect of change involves the way those affected by change think it will alter their established relationships in the library organization. If a change threatens the usual pattern or style of their social relationship, then the changes will be met with resistance. For example, if a librarian is used to a relationship with his supervisor in which he has some input into the proposed changes, then is forced to change work style without explanation, he will feel threatened as to his role in the social millieu of the organization. Understanding these social aspects of change are equally as important as the technological changes, and must be considered and dealt with before any change can be implemented.

A third way of reducing resistance to change is by developing a cooperative atmosphere between those who are implementing the changes and those who are affected by them. The technical people involved in developing the changes must consider the changes from the operators' and users' points of view and be willing to work with them in making the changes. Library management must not ignore the "know-how" of their employees, or the pride of the employees in their work, but instead utilize their capabilities in helping the changes succeed. The technical people must be willing to explain the changes in easy to understand terms so that the employees can really understand what the changes involve.

Another important cause of resistance to change is misinterpretation by the librarians and users as to why the changes are taking place and their effect on the library environment. Management must foster good communication about the changes, encouraging discussions and information sessions as to the exact content and effects of the changes. In addition, newsletters, memos, flyers, and pamphlets can be circulated to keep people informed and up-to-date on the progress of the changes. It is important that this communication precede the actual implementation, so as to allow people time to digest and prepare for the changes, rather then be surprised and possibly resistant to them.

An additional way of reducing resistance to change is by fostering a general climate of change within the library. Personnel can be encouraged to attend outside courses, lectures, or seminars conducted on new areas related to their work. They can also be allowed to rotate assignments in order to broaden their managerial scope and stimulate their imaginations about what can be done with the work situation. In addition, employees can be allowed to experiment with new methods and be given objective evaluations of mistakes as learning experiences, rather then criticism. By establishing the organization as being open to change, the employees will be much more receptive to changes taking place.

In summary, by understanding the needs of both librarians and library users and making them a part of the changes, much resistance to change can be reduced. If library management is willing to take the time and effort to achieve these goals, librarians and users will not be obstacles to the success of a new program, but willing participants in change.

CHAPTER 5

PLANNING FOR CHANGE

The success of any project to implement change in an already operational environment is dependent on careful planning. This is especially true when the project involves the incorporation of new technology, a situation which often fosters apprehension and anxiety among those who will be working with the technology. The inherent problems of incorporating new technology into existing operations were discussed in the previous chapter together with some ideas as to how resistance might be overcome. This chapter puts those ideas into a broader planning framework which attempts to outline a planning process* which public libraries can use to plan any changes in technological applications, procedures or operations. Most librarians agree that some degree of planning is essential to effective library operation. Often, however, public library planning has been rather short-term and haphazard-initiated as needed rather than systematically and continuously with regular reviews. This chapter concentrates on how the planning process referred to above can be used to plan for technological change and help to overcome special personnel and environmental problems. Finally, the risks involved in applying very fast-moving technologies, such as almost immediate obsolescence, are discussed.

5.1 How to Get Started

The first step towards a successful planning exercise is to prepare for the fact that the inevitable outcome is *change*, so that the participants in the

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*The Planning Process for Public Libraries was developed at King Research, Inc. under a grant from the U.S. Office of Education, Department of Health, Education and Welfare.

planning process should be flexible enough to accept it. The planning process requires that the library plan in conjunction with its community. In other words, the planning process is based on a participative approach involving participants at all levels, users, operators, managers, administrators. In the public library environment, therefore, a planning committee should be established which includes representation from the library, from the community the library is supposed to serve, and from the library's governing body. It is not the library that is to make the decisions about how it will serve its community, rather it is the community which is to decide what role the library should play. Such an arrangement is critical if the library is to serve its entire constituency and not just the small segment of the population which has traditionally used libraries.

The planning manual outlines three activities necessary to conduct the planning process. They are:

- Selection of a broad-based planning committee. A committee of not more than 15 is recommended. The committee should include representatives of minority or other special interest groups and non-users of the library as well as those already referred to above.

- Determination of feasible scope of the planning effort. It is important that the committee determine the extent and limitations of the planning activity so as not to raise unreasonable expectations in the participants. The library may be aware of particular problem areas which the committee should address. Not only should the boundaries of the planning activity be defined, but the boundaries of the supporting activities, such as data collection, should also be drawn at this time.

- Data collection and analysis for use by the planners. Planning library services for a community requires knowledge about that community, about the individuals within it, and about their current information requirements and sources. Data can be collected in several ways, including the use of survey instruments, public library statistics (usually in the form of management reports), public meetings, or secondary sources (census reports, local government documents, etc.). The manual recommends primary data collection (collection of data from individuals) by means of 5 different surveys as applicable. The 5 surveys relate to library staff, citizens (or residents), students, users and special groups.

In all of the above preparatory activities, it is important to highlight and define special problem areas, to expose the planning committee to the needs of various groups and to increase the committee's understanding of them, and to identify methods for solving problems, meeting needs or reaching larger sections of the community.

5.1.1 The Planning Process

The planning approach outlined in the manual has attempted to present ways in which the general process can be adapted to the specific needs of public libraries. The basic steps identified as part of the initial planning cycle (the approach is cyclical so that after the first cycle some of the steps may no longer be necessary or appropriate), in which a long-range library plan is developed and implemented are:

- Assessing community library needs. This step involves the assessment of the community environment and characteristics of its individuals as they relate to the public library. This will include the determination of potential information needs, resources in the community to meet those needs, the availability of those resources, and the environmental and population characteristics which may encourage or inhibit delivery of library services. Characteristics which may influence planning decisions include age, education, occupation, geographic distribution, proximity of educational and cultural facilities, and types of local businesses and industries.

- Evaluating current library services and resources. The main objective of this step is to determine how well the needs identified above are met (if at all). Several different measures can be used to evaluate the quality of community services, e.g., coverage, timeliness, accuracy, performance, efficiency.

- Determining the role of the public library in its community. Public libraries exist to fulfill the cultural, educational and recreational information needs of their communities. The Public Library Mission Statement[49] presents a broad statement of public library service philosophy. The planning process, however, requires an action statement that details the actual role the library will play in its own community during the planning period. For example, the public library planning committee may decide to install equipment to access a Videotex system. Part of the action statement then would include the education and training of both library staff and library users.

- Setting goals, objectives, and priorities. This activity represents the nucleus of the whole planning process. Long-term goals are viewed as broad statements of desired ends, whereas objectives are defined as specific targets within the goals. Each broad goal may have several objectives associated with it. As far as possible, the objectives should be measurable. The goal-setting process usually results in a larger number of objectives than can reasonably be accomplished by the library. Consequently, it is necessary to set priorities across the objectives so that alternative solutions can be evaluated according to their ability to meet the prioritized objectives.

- Developing and evaluating strategies for change. Strategies are the actions taken to achieve the goals and objectives determined above. Often, libraries must reevaluate their traditional systems and services and either change and update them, or develop totally new ones, to serve their communities more effectively. The alternative strategies to achieve a particular objective or set of objectives can be evaluated by their ability to meet the prioritized list of objectives according to certain prioritized evaluation measures, such as cost, performance, effectiveness and benefits.

- Implementing the strategies. The outcome of this step is a detailed implementation plan which will guide the library to implement the changes necessary to improve its service to the community. It is important that each implementation step not require too large a change, because then there may be some serious resistance which could lead to the failure of the whole planning activity. Implementation plans should make each of the steps leading to a full-scale implementation seem achievable and of some merit to implement even if no further steps are taken. It is important that implementation causes a minimum of disruption to the daily operation of the library, its staff and its users.

- Monitoring and evaluating progress. The development of procedures for monitoring, measuring and evaluating performance is the final step in the first planning cycle, and its implementation is the beginning of the next. It includes the review of secondary source data for any changes in the community or its residents which would affect the role of the library or the delivery of library services; updating the goals, objectives and priorities so that they remain relevant; review old strategies and develop and implement new ones as necessary.

The manual recommends that this cyclical approach be part of a continuous process. At the end of 5 years, a new committee should be assembled and begin a complete reassessment of library role and goals.

It is assumed that a library can conduct the planning process without external assistance. However, consultants may be useful in helping to determine the scope of the planning activity, ascertain the information needs of the community and its residents, and determine and evaluate alternative strategies for meeting those needs. Appendix A contains a list of potential consultants and consulting firms with experience of new technology in the library and information field.

5.2 Feasibility Analysis and Design

In the following sections we will discuss an approach to performing the full range of activities associated with the analysis and design portions of the systems development process. Often, analysis and design activities are structured around the following series of tasks:

- Prepare a Functional Analysis
- Review the Present Operating Environment
- Project a Technological Assessment
- Develop and Evaluate Alternatives
- Make recommendations.

The descriptions of each of these tasks encompasses a very wide scope. We realize that the degree to which each task methodology should be pursued will vary widely for different projects. Our purpose here is to present our approach in its broadest form.

5.2.1 Prepare Functional Analysis

To a large extent this step will be based on the data collected and analyzed during the planning process. It relies on statements of goals and objectives which are ranked in order of importance (to those who developed them). In the same way, statements describing the functions of the environment within which the new technology is to be placed will also be required. Using these statements, two sets of relationships can be described. The first considers the relation between the organizational structure of the library and its objectives. This can be done in the form of an organization/objective matrix. The second set of relationships compares the objectives of the library with the functions being performed. Again, the information can be presented in the form of an objective/function matrix. Upon completion of this step, an overall view of the mission and activities of the library will have been developed.

5.2.2 Review the Present Operating Environment

Based on the functional analysis performed in the previous step, a detailed analysis of the current operating environment can proceed. The functions identified are described in terms of

- interrelationships
- performance
- reliability
- required resources
- costs.

The primary descriptive tools for accomplishing this are:

- data flow diagrams
- function/resource matrices.

Data flow diagrams serve to depict either the physical or logical view of information handling. They graphically document the relationship between named processes and data files by connecting them via directed lines (flows) representing the inputs and outputs of each process and file. Physical data flows are produced first and exhibit the following characteristics:

- process descriptions include the name of the person/group performing the activity
- physical resources allocated to each process are identified
- volume estimates are attached to each file and data flow
- processing time requirements are associated with each process
- processes and files are characterized as to their degree of automation.

Physical data flow diagrams will be prepared for each function identified previously. The level of detail in the diagram will be appropriate to the function it describes.

Based on the physical data flow diagrams, logical data flow diagrams and function/resource matrices can be produced. Function/resource matrices relate specific processing and data resources to those functions which make use of them. These matrices have three primary uses:

- they assist in documenting the costs associated with performing a particular function
- they identify which resources must be upgraded to improve the performance of a particular function
- they identify which functions would be affected by varying the performance characteristics of a particular resource.

Thus, these matrices, taken in conjunction with the organization/objective and objective/function matrices, will be important inputs to the analysis and evaluation undertaken in subsequent steps.

Logical data flow diagrams will also be produced based on physical data flows. Logical data flows are similar in format to their physical counterparts except that they focus on the "what"rather then the "how" of a process. They are thus generally simple to review and will provide a baseline of activities from which a new, more fully automated physical view can be developed.

5.2.3 Project a Technological Assessment

Automated systems currently under development are likely to have a significant impact on traditional concepts of what information handling systems should be like, and on the people who interact with them - on those who manage and operate the systems and, in particular, on the people who use them. User requirements will continue to adapt and evolve as new system capabilities and improved products and services emerge. It is, therefore, important to understand the likely nature of this evolution when approaching the design of a new system.

It is important that both ongoing and projected research and development work be included in the technological evaluation. Ongoing activity should be monitored through contacts in libraries and system and service vendors both here and abroad, through literature surveys and through conferences, meetings and exhibitions.

Short-term automation solutions should not be selected for further investigation unless they can be seen as a stepping-stone in an overall long-term evolution process that ends in the most relevant technology for the operation of the library under consideration.

5.2.4 Develop and Evaluate Alternatives

Performance of the first two tasks will provide an in-depth understanding of the mission of the library and its present mode of operation. The results of the third task will be a projection of how the present environment is likely to change and what technologies will be available to meet the library's present and future requirements. This task integrates these two streams and produces alternative automation approaches.

In addition to these inputs, the development and analysis of automation alternatives will be guided by two further parameters:

- closed system versus open system alternatives
- immediate versus phased implementation approaches.

In the previous tasks, analytic activity was focussed on the library as a single unit. At this stage, however, we include, among various alternatives, those which assume modifications to the transmission of information between the various branches of the public library and to the user at home. Alternatives which may seem attractive from the viewpoint of the main library may impose undue sophistication on the local branches. It is important that the alternatives which are evaluated include the environments both internal and external to the library (as displayed in Figure 3, p. 27).

In general, a phased approach to incorporation of new technology is favored.

When performed effectively, phased implementation provides a number of significant advantages:

- the ability to integrate new technologies as they become available

- the ability to react to unforeseen changes in the internal or external operating environment

- time for repeated evaluation and feedback regarding the performance of the developing system in light of specified requirements and operating parameters

- time for operating personnel to familiarize themselves with new technologies in a gradual step-by-step manner.

Arguments against phased development center around cost in terms of

- hardware acquisition
- retraining of operating personnel
- modification of application software.

Such arguments seem more appropriate to environments where there is no manual system currently in place or when phased implementation proceeds in an unplanned fashion.

Correct phasing of system automation exhibits a number of characteristics, including:

- straightforward transition from the existing manual component to its automated replacement

- immediate, quantifiable performance benefits accruing at each stage of automation

- minimal need to reconfigure an automated component due to the later automation of related components

- proper timing of system enhancements to keep pace with changing operational requirements (increased workload, etc.)

- minimal disruption of the operating system by the implementation of new automated components.

The technical feasibility of each automation approach selected will be examined thoroughly and related back to the questions and issues which arose during the technological assessments. In particular, we should be concerned with whether the technical capability already exists within the library to implement and support each alternative approach to automation. If such capability does not exist within the library, then recommendations will be made on how best to acquire it, both on an immediate basis and on a long-term basis. These recommendations will allow the library to match phased implementation in the long term with the timely acquisition of sufficient and appropriate resources to support each implementation phase. These resources include trained personnel, equipment, software, management strategies, etc.

In order to do this, it is first necessary to determine, for each candidate alternative, the technical support that will be required for its implementation, operation, maintenance and future development. Then it is necessary to see whether any of the required support is already available. If not, or if only partial support currently exists, then suggestions can be made as to how to acquire the appropriate level of support both in the short term (e.g., hiring new staff with the required skills or obtaining contractor support) and in the long term (e.g., gradual retraining of existing personnel) so that the library can ease into a new system. Making both sets of suggestions will help to rank and select among alternatives, from both a technical and an implementation viewpoint.

A second aspect to documenting technical feasibility is to consider the technical environment external to the library. This will involve assessing the stability of the industrial and commercial base which will be producing the technology required for the system, which is, in turn, related to market forces and economic trends.

The next step is to evaluate each of the candidate alternatives according to its operational feasibility within the library system. Three different aspects of the operational feasibility of a new system in a library can be examined:

- introduction of proposed system into the organization
- day-to-day running of the system
- effectiveness of the system in meeting organizational objectives.

Introducing a new system into any environment requires careful planning to ensure either a smooth "running-in" period (if there was no previous system) or a smooth "take-over" period (if converting from one system to another) without any serious disruption of the daily routine. To assess the ease with which the new system can be introduced into a working environment, such factors as the reassignment of personnel to specific operational tasks, the retraining of personnel, the reorganization of operating procedures (e.g., data may need to be collected and handled in different ways), and any rescheduling of activities that are necessary as a result should be taken into consideration.

The feasibility of operating a system from day to day can be evaluated by considering the volumes of information that have to be handled by the system - as input and output - and the timing requirements (e.g., frequency and urgency of requests). How well the system copes with breakdowns in various system components and contingency plans in case of total system failure must also be taken into account.

The final step in this evaluation stage is to consider the economic feasibility of the alternatives. Basically, the approach begins by identifying the functions that are performed in the library. Within each function there are information activities, products and services that are employed to accomplish the function. Sometimes more than one activity, product and/or service is used, for economic or other reasons. Each activity, product or service is made up of processes, which can usually be decomposed into input, processes, and outputs. Within the processes are components, which consist of people, equipment, supplies, etc.

It is almost always possible to uniquely define a library by subdividing it into its functions; activities, products or services; processes; and components. By so doing one can create useful cost models that include all the apparent as well as hidden costs. One can also establish relationships among all of the subelements given above. This structure lends itself to determining performance, effectiveness and benefits of the library. It is then possible to look at alternative system components and establish their contribution to cost, performance, effectiveness and benefits.

Costs are the resources that are allocated to a system. Performance is the measure of quality (e.g., speed, reliability, accuracy, etc.) or quantity produced by a component, process, activity, product or service. Alternative components will achieve different levels of quality or quantities produced at different costs. One can usually measure the cost and performance, although often one must rely on a vendor's statement of performance. Effectiveness is measured from the library user's perspective such as number of times used or user satisfaction with the service. Presumably, improved performance will achieve greater effectiveness, although the relationship is often hard to establish. Cost effectiveness then can be measured by such comparisons as cost per use. Benefits are the consequences of the library system such as improved access to literature. The greater the effectiveness of a library (i.e., the more the library is used or the better satisfied users are), the greater the benefit that will be derived. Benefits are hard to measure, and sometimes judgments must suffice. The above framework has been found to be very useful in conducting feasibility studies.

Costs can be computed by identifying direct costs associated with each component, and aggregating them over the processes, activities, products or services. The costs can also be modelled by fixed and variable costs so that one can simulate effects of changes in number of items input, amount of labor, changes in labor rates, comparison of equipment components, etc. Costs of alternative equipment or of alternative systems will be assessed using a present value analysis if appropriate. Finally, attempts should be made to allocate indirect costs and overhead costs to the library functions and their subelements.

Such a cost model will also permit the establishment of trends in costs of components (e.g., labor costs, supplies, equipment maintenance, etc.) in order to project costs over time.

An essential ingredient in the effective planning and analysis of information systems is the assessment of system flexibility and adaptability in coping with a changing environment. It is also necessary to test how a change in a simple system component (e.g., a new type of processor, additional service requirements, etc.) affects the total system performance.

Modern systems have long lead times - generally 3 to 5 years from design to implementation. Since the selected system will support the goals and operational objectives of the library, it may be assumed that these will change substantially during a system's life cycle. Thus, it must be assumed that the user's information requirements will also be substantially altered. On the whole, users continually demand more sophisticated information services. Consequently, new information systems must be able to adapt to continual change.

A critical requirement for such adaptability is that the system possess sufficient excess capacity to accommodate change quickly and at low cost with as little disruption to operations as possible. Additionally, alternative systems must be analyzed to determine the degree of risk inherent in their designs which could prevent them from attaining design objectives. These risks stem from:

a) negative impact of the system on the user community (organizational risk)

b) reliance on unproven technology (technological risk)

c) inability to effect transition from the current system to the target system (transition risk).

5.2.5 Make Recommendations

The major objective of this task is to pull together the results of each of the assessments and to order the alternative automation approaches according to how well they meet the stated objectives of the library. The various alternatives will be matched against these recorded objectives and performance standards, and those best-match alternatives with high feasibility (for the combination of technical, operational, and economic feasibility) and high sensitivity will be ranked above those alternatives which either match the objectives but have lower feasibility and sensitivity, or which do not match the highly ranked objectives so well but have high feasibility or sensitivity.

Given today's long lead times for equipment procurement and delivery, the scheduling of activities during the process of implementation (from the time a system is selected to the time it is operating in a 'live' environment) is important so that no unnecessary delays are introduced. The various activities that must be scheduled include:

- initiating the procurement process
- delivery of equipment
- facilities preparation
- installation of equipment
- testing of delivered equipment
- testing of new system
- training of appropriate personnel
- phasing-in operation of new system.

These activities will be scheduled using milestone charts, for each candidate automation approach. It is important to make assessments of when the technology underlying each alternative will be available. These will enable the library to select among alternatives. Similarly, resource reallocation requirements and any proposed changes to management controls could be used in the final selection.

It is possible that the automation approaches deemed most suitable for the library functions are many years from production. If so, then interim solutions can be proposed, and the various intermediate automation phases will be scheduled so that they ultimately lead smoothly into the most appropriate system. However, if such a long-term solution is desirable, then it will be necessary to review technological developments from time to time for any new (previously unforeseen) approaches that may emerge.

5.3 Equipment Selection and Procurement

The outcome of the feasibility analysis and design is a recommended system approach. The next step is to select a vendor who will supply the equipment or service. This selection process is critical to successful application of new technology in any environment, and it is at this stage that the library may wish to engage the services of a consultant familiar with the technology to be implemented. Technological development is moving at such a rapid pace that it is difficult to keep up with. The advice of experts on currently available systems and services could help the library avoid costly mistakes.

There are a number of criteria which should be considered when selecting equipment or services. In many cases, a vendor's system does not provide all of the capacity and features that a library requires. Sometimes the vendor will indicate that improved capacity or additional features are imminent. However, many libraries have found themselves expecting such enhancements for some years. If the missing service is critical to the library's operation and if the vendor's commitment to supply the services was used as a basis for selection, then the success of the entire project is in jeopardy.

Another serious problem is incurred by acquiring a system with insufficient capacity for the load imposed on it. Systems must be bought to allow for some level of growth. There are essentially two ways to increase the capacity of a system or service: one is to enlarge the existing system or service (for example, by increasing the amount of storage in an online circulation system); the other is to duplicate the existing system or service (such as doubling the number of Videotex terminals available for public access), often referred to these days as the "cloning approach". When the system is unable to cope with the load imposed on it, then the effect on the user is a slower response time, which leads to user frustration and an ultimate decline in use of the service.

According to Epstein[13], the addition of new equipment or upgrading of existing equipment due to inadequate capacity occurs in a large percentage of existing library automation system installations. The key reasons for this type of failure are underestimation of number of titles, circulation transactions, users, etc. or addition of other libraries or branches to the system. In some cases, the library has specified the functions required, the anticipated activity of the system and the response time required, and the system is unable to meet these requirements even though the vendor insisted that it would. It is recommended that, to avoid such a situation, acceptance tests be required (these are discussed later on p. 112).

The following steps should be taken to ensure the selection of the most appropriate system or service for the library:

- Write a 'Request for Proposal' (RFP)
- Evaluate proposals
- Test and accept system.

5.3.1 Writing the RFP

The Request for Proposal (RFP) describes all the features and services the library requires of the system to be implemented. Each feature and service should be designated as mandatory, desirable, or optional. In the majority of applications, it is vital for the library to produce a formal, written RFP, the primary purpose of which is to obtain formal, written proposals from several potential vendors. The RFP can be based on the feasibility analyses and design phase. If necessary, some of the planning documentation can be added for background information so that the vendors can determine how the system they are proposing will fit into a long-term plan. Contractor assistance is often required in the preparation of RFP's and the evaluation of ensuing proposals.

A broad view should probably be adopted in defining the unique components or elements of an RFP so that the specification of the library's requirement is stated consistently and in contiguous sections of the solicitation document. The following is a listing of the key elements (not a contents page) for an RFP of a general type:

Background Statement
Scope of Work
Mandatory Requirements
Optional Requirements
Delivery/Completion Schedule
Quality Assurance, Acceptance Tests
City-Furnished Equipment, Assistance, etc.
Attachments and Exhibits
Proposal Evaluation Criteria
Special Instructions

A core section in an RFP is, of course, the statement of requirements---mandatory and optional---for the automated library system. Developing this section of an RFP is essentially a creative, professional task, where a reciew of the library's expressed requirements and knowledge of available systems is translated into specifications for (a) software, including operating systems and applications software; (b) hardware, including modems, terminals, and telecommunications lines; and (c) management, including installation, testing, training, and documentation.

These requirements are augmented by the ones covered in the special proposal instructions to vendors for the following:

Statements of warranties
Policies for maintenance and service
Required versions/releases of proposed systems
Packaging, shipping, and delivery
Nomenclature and models
Locations and contact points for sites where the proposed system is operating.

5.3.2 Evaluate Proposals

The vendors who respond to the RFP will describe their systems in as flattering a light as possible. They often include, as part of their proposal, a certain amount of sales literature - the "glossies" - which describes the products in extremely general terms. These materials all too often outline system enhancements or new features which are not actually available at the time. One way to determine the current status of any system is to arrange for a demonstration of the system. If the vendor has the system installed in a library elsewhere, then it would be advantageous to arrange the demonstration at that site. However, even if this is not possible, it is important to talk to those who are working with the system. Users are considerably more inclined to admit problems with the system than vendors (obviously) especially if the users are actually in direct contact with the system.

The vendors' proposals should be reviewed and evaluated against a predetermined set of prioritized evaluation criteria (usually based on the feasibility analyses and design) and a single vendor selected.

5.3.3 Testing and Accepting the System

The acceptance criteria for the system should already have been outlined in the RFP. Once a vendor has been selected, then a benchmark test should be performed (by, and at the expense of, the vendor). The benchmark test should, as closely as possible, simulate the activity to which the system will be subjected in the library. In particular, care should be taken to ensure that the response time of the system is adequate with the expected load of users and the expected mix of transactions (e.g., in an online circulation system that the response time not drop below 30 seconds for check-in or check-out at peak activity times). The insistance on benchmark testing can help the library. If a system fails to perform adequately in the test, then the library can request that the vendor upgrade or enhance the system or else be disqualified. If, however, no benchmark testing is required and the system, once installed, fails to perform adequately, then it is the library that must bear the cost of the upgrade.

After successful benchmark testing, the library can proceed with contract negotiations. In most cases, the vendor will offer a "standard" contract for equipment provision and services rendered. These contracts are written to the vendor's advantage. The contract should be studied carefully and any proposed changes documented. It may be necessary at this stage to involve a legal representative for the library to negotiate with legal council for the vendor.

Finally, after the contract has been approved by the library and the vendor, the library should organize an acceptance test (the acceptance criteria were defined in the RFP). The test will ensure that the configuration of equipment installed by the vendor meets the library's functional and performance requirements. The acceptance testing is done on the equipment that the vendor has installed in the library. Once again, if the system fails to perform adequately, then the vendor must remove the equipment from the library, at no cost to the library, and the library is free to select another vendor.

5.4 Personnel Problems

As discussed in Chapter 4, there is an inherent resistance to new technology from which librarians and library users are not exempt. It is important, therefore, that any project undertaken by a library to incorporate some form of new technology into its operations or services take this resistance into account through all phases of the project. The resistance will exist both in librarians and in the community the library is intended to serve.

In discussing the effects of technological developments on information professionals, Barron and Curnow[3] state that one of the most serious barriers to the successful exploitation of new technologies is the lack of technical awareness and technical expertise, particularly about the microcomputer. An important step, then, in preparing library staff, and existing and potential users is their education. This can be achieved through formal courses, workshops, seminars, discussion groups and so on. First, librarians should be thoroughly aware of the changes planned for their library. This will happen without much additional effort as a result of the planning process if conducted correctly. If the planning committee includes representation of the various constituencies, both inside and outside of the library, each representative bears the responsibility of disseminating the outcomes of the planning activities.

It is important, for a variety of reasons, that librarians familiarize themselves with new technologies. First, they will increasingly receive queries about new technologies as part of the reference service, and will need to at least refer patrons to the appropriate information source, whether it be an encyclopedia or the local computer store. Second, if any automated equipment or new technology used by the library is visible to the patrons (such as a circulation control transaction terminal), then the librarians will be asked questions about the system. As the library users become increasingly familiar with new technologies outside the library environment, the librarian must also keep up, at least with these technologies applied and available for use within the library, in order to maintain some level of credibility with the users. Serious confidence problems could arise if this does not happen, which might affect the role of the librarian and the library itself in the community.

It may be necessary for the library to initiate some form of advertising to inform their community of the new system or service, particularly if it is appropriate for those who were previously unable or reluctant to use the library - the blind, the housebound and the non-readers. Some public libraries have made use of the local newspaper, and radio and television station to advertise their services and activities. Videotex, teletext and cable TV systems can also be used.

Once the educational programs have been established and run, periodic updates should also be organized for both the librarian and the user. In this way, librarians will be able to understand how to respond to the changing needs of their user community, and the users will understand the range and extension of library services available to them.

5.5 Physical Environmental Problems

New technologies, and particularly those incorporating some electronic communications are often sensitive to environmental conditions such as temperature and humidity. Although in Chapter 3 we described the increasing reliability of micro-electronic circuits, they are used mainly as components of larger systems. It is the systems that tend to be environment-sensitive. Often it is the peripheral equipment that is affected, such as disk drives. These have a tendency to overheat if used continuously and cooling fans may be required. Floppy disk drives also tend to be sensitive to dust and smoke because they are not sealed in containers.

Another frequent problem is caused by electrical discharge or the building up of electromagnetic fields through metal columns in the structure of the building or metal book stacks. Microcomputers or word processors should be insulated from metallic objects.

Finally, a stable power supply is required, particularly if systems are mounted on minicomputers. Many installations originally ignored this environmental factor and at peak power surges their system "crashed" and was unavailable for some time. Either an uninterruptable power supply can be installed, or a peak load voltage suppressor.

Other aspects of environment to be considered relate to the intrusion of the physical presence of new equipment on the existing library atmosphere. For example, the presence of a computer terminal or TV in the library, apart from taking up space, causes no serious disruption to those around it (the clicking of keys can be silenced) whereas a microcomputer system or word processor with a printer would make a considerable amount of noise (even when equipped with an acoustic load). This problem is no different from that of typewriters which several public libraries have placed in soundproofed booths. The space and sound-proofing requirements should be considered carefully as part of the systems' evaluation.

Yet another aspect of environment is security. Security involves physical security (particularly for portable equipment), access control, and hardware and software security for library management systems (such as circulation control).

5.6 Postimplementation Evaluation

After the equipment has been installed and operational for six months to a year, a postimplementation evaluation is recommended. This evaluation will determine whether or not the new system meets the objectives stated during the planning, analysis and design activities. The evaluation should be as objective as possible. Consequently, consultants are often asked to perform the evaluation. The evaluation results should feed back directly into the planning process, initiating a whole new cycle.

Evaluation involving new technology must be an integral part of the entire system life cycle. Information systems have life cycles that consist of overlapping, interconnected, and iterative phases: planning and feasibility analysis, design, implementation, operation, and planning again. As shown in Figure 4, evaluation can have a role during each phase. In general, evaluation methods during the planning and operating phases differs somewhat from that used in evaluations conducted during the design and implementation stages. The first phases make more extensive use of simulation and experimentation techniques, while the latter phases provide more opportunity for observational and descriptive techniques. The implementation phase uses both types of techniques. Evaluation is discussed below for each of these phases.

5.6.1 Evaluation During the Planning Phase

Basically, the planning process is a structured framework for continuous problem solving based on a combination of objective and subjective information. The role of evaluation in this process is to provide the basic information for designing and redesigning the program, policy, or system.

The planning task entails making decisions based on the predicted effects of alternative actions. Decisions are also made on the basis of results of past decisions. This is the control function of both planning and evaluation. Techniques most often used in evaluation during the planning process include observational studies, surveys, and descriptive models of the system. For example, once the planning committee has developed several strategies for possible implementation, it is necessary to evaluate the strategies to determine the best methods of reaching the desired ends. Techniques used for evaluating proposed strategies (i.e., for evaluating alternative actions for accomplishing the previously determined objectives) include cost, benefit assessment and the experimental approach. Benefit assessment attempts to guide the planning committee through a thorough discussion of the probable impact of a strategy upon each objective. The question asked is essentially "How much better can the system or new technology accomplish each of its objectives if the strategy is adopted and implemented?" Because a strategy designed to further one objective may affect another, for better or worse, each strategy has to be evaluated against each objective. This requires some means of forecasting the incremental gain or loss from what is currently being accomplished. This may be a subjective

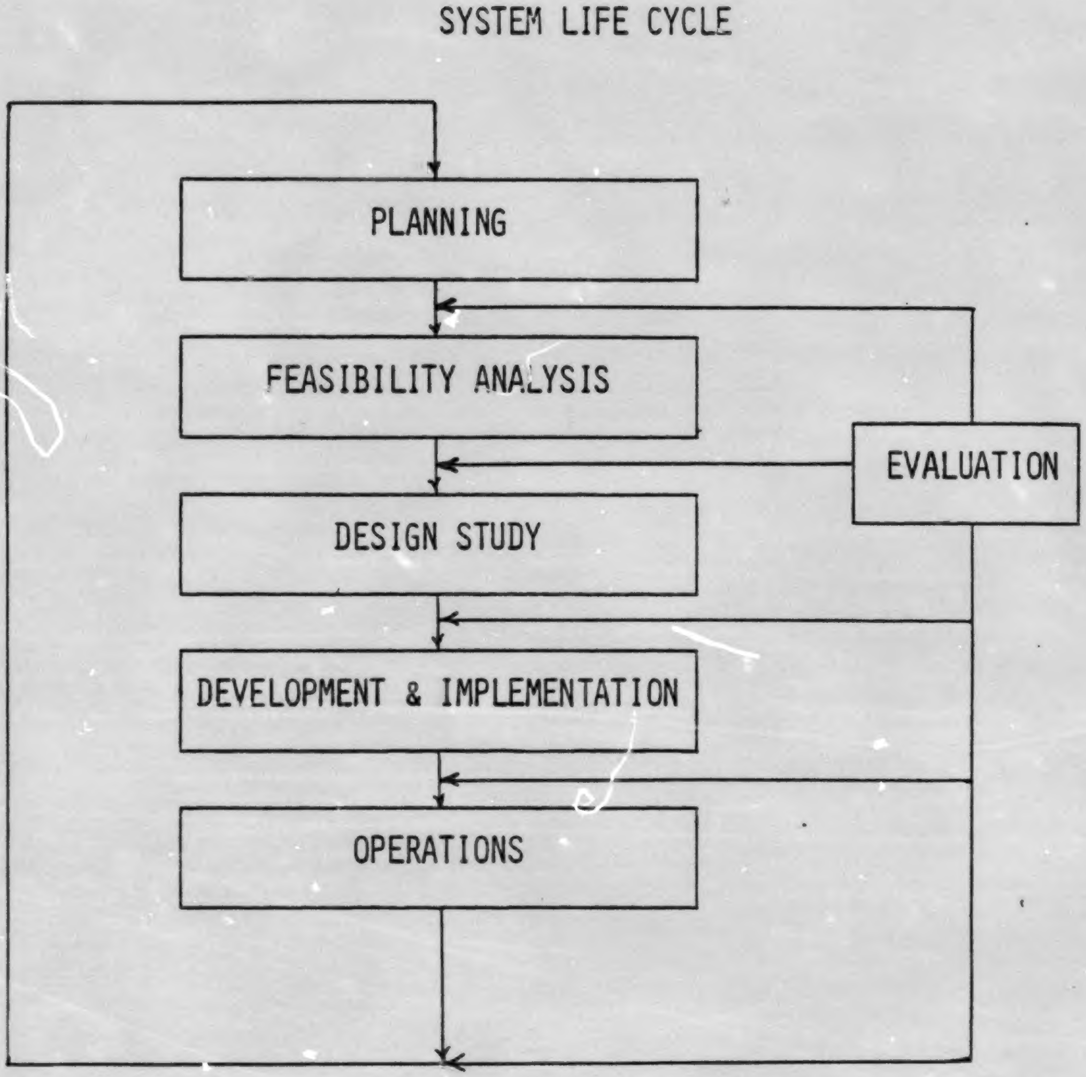
SYSTEM LIFE CYCLE
PLANNING
FEASIBILITY ANALYSIS
DESIGN STUDY
DEVELOPMENT & IMPLEMENTATION
OPERATIONS
EVALUATION

Figure 5. Evaluation as a Part of a System Life Cycle

exercise, because it relies on the planning committee members' expectations of the effects of strategies on objectives; but it is absolutely necessary to evaluate strategies for possible implementation. There is also the experimental approach, whereby strategies are tested by limited application in only one part of the system.

Planning, like the evaluation process it includes, is ongoing. A long-range plan is developed as part of the initial cycle of the planning process. It includes the monitoring and evaluation of the system's plan itself and evaluation of the continued relevance of current system operations, services, and products to the needs of the users to be served.

5.6.2 Evaluation During the Design Phase

Evaluation research provides the basic information for designing and redesigning programs, policies, and systems. In addition, evaluation studies have as one of their purposes to assess designs prior to implementation. In the design process, the decision maker must begin to consider multiple alternatives under multiple conditions. The decision among alternative systems is rarely a simple one with one alternative clearly dominating all others. Usually, one system or alternative technology appears to be superior with respect to one objective but not to another. The evaluator's function is to provide the decision maker with an explicit and rational analysis. Consequently, evaluation of design alternatives often implies the use of models. Depending on the alternative, the model may involve only verbal statements of cause and effect; or a mathematical model can be developed to provide necessary data. Computer simulation may be used.

In some instances, research precedes design. When research is performed, evaluation plays an important role in observing, describing, and simulating the information environment under different conditions. These evaluation techniques provide the opportunity to consider the information environment under different conditions and perhaps anticipate potential problem areas before the actual system is operational. Experiments conducted as part of the evaluation procedure in such a research context can be performed to understand more of the phenomenon of user satisfaction by measuring as many of the different aspects of it as possible. The increased knowledge of user behavior can be used to accurately adjust the conditions surrounding computer- or electronic-based services to increase user satisfaction.

5.6.3 Evaluation During the Implementation Phase

Once a plan has been developed and the system designed, the next step is its implementation. Evaluation is performed during this phase to check the match between the implementation and program expectations. Evaluation study results may suggest needed adjustments before the system becomes operational. The principle objectives of this evaluation is (1) to predict the performance of the system once it is made operational; (2) to reveal specific needs, if any, for modifying and correcting the system before changes become too costly; and (3) to perform a preliminary investigation of operational strategies.

5.6.4 Evaluation During the Operational Phase

As part of the planning process, decision making was based on the predicted effects of alternative actions. In the operational stage of the information system, decisions are also being made on the basis of the results of past decisions. There are numerous examples of the evaluation of operating systems---evaluation is undertaken routinely in connection with quality control and in connection with the ongoing, long-range planning process that is part of most operating systems.

Evaluation studies of operating systems have one or more of the following purposes: (1) to discover whether and how well objectives are being fulfilled, (2) to determine the reasons for specific successes and failures, and (3) to uncover the principles underlying a successful program. Questions for evaluation at the operational stage include these: How good is the technology? What effects is it having? Is it working as expected? The quality of the results (expected or realized) is weighed against the resources required.

Information upon which to base the evaluation of current services is gathered from various sources: currently collected statistics, measures of system performance or effectiveness, and surveys. For example, the methods used in designing an information retrieval system for a group of users (e.g., in-depth interviewing and user profiles) can be used to collect new data that, when compared to earlier data, make it possible to evaluate the success of the system in attracting its target population.

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GLOSSARY

AMIGOS:	Interuniversity Council of the North Texas Area - a consortium of over 100 libraries in the Southwest, providing cost-effective access to OCLC and supporting other cooperative bibliographic projects.
BATCH:	Batch mode processing refers to a user not being in direct contact with the computer. Its major disadvantage is that errors cannot be corrected and resubmitted until after the program or activity has been run.
BETAMAX CASE:	The Betamax case involved the alleged illegal home recording on Sony Betamax videotape recorders (for home viewing) of free television broadcasts of copyrighted films.
CAI:	Computer Aided Instruction
CPU:	Central Processing Unit - the heart of a computer system where all the processing takes place.
INTEGRATED CIRCUIT:	A complete electronic circuit fabricated in a single piece of semiconductor material.
MACHINE CODE:	The symbols that a computer can recognize in order to perform basic operations - this is the lowest level of interaction with a computer (i.e., farthest removed from natural language).
MARC:	Machine-Readable Catalog - the system used to maintain the Library of Congress' machine-readable files of cataloging and authority data; used in preparing, transcribing, proofing, correcting, and verifying cataloging and authority files for input to a store of approved machine-readable cataloging records.
OCLC:	Online Computer Library Center (formerly the Ohio Colleges Library Center) - an international bibliographic computer and telecommunications network which enables academic, public, special, and federal libraries to acquire and catalog books and other library materials, order custom-printed catalog cards, arrange interlibrary loans, and maintain location information on library materials.
ONLINE:	Refers to the mode of interaction with a computer system. With online systems, a user is in direct, interactive contact with the computer and therefore maintains control of the activity to be performed.

GLOSSARY
(Continued)

PHILIPS:	The Philips Industries are a group of companies that specialize in electronic and audio systems, as well as electrical household goods.
RLIN:	Research Libraries Information Network - a bibliographic utility operated by the Research Libraries Group (Stanford University); its membership is comprised of large academic research libraries drawn predominantly from a listing of research libraries compiled by the Association for Research Libraries.
SEMICONDUCTOR:	A solid material with properties of conducting electricity which lie between those of good conductors (metals) and poor conductors (insulators).
SOFTWARE:	The internal programs or routines that specify the operation of a computer.
SOLINET:	Southeastern Library Network, Inc., a broker of OCLC services in the Southeast - is currently developing additional services to enhance those available from OCLC.
TURNKEY:	A turnkey library automation system is one for which the vendor is responsible for supplying hardware, software and ongoing maintenance.
VIDEOPATSEARCH:	A videodisk-based retrieval system which links online searching of bibliographic files of patent literature to online retrieval diagrams from the patent documents. The system is marketed by Pergamon International.
WLN:	Washington Library Network - a consortium of 8 regional libraries - developed a computerized cataloging system with a variety of additional modules.

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